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Event and Comment

The Australian Agricultural Council.

AMONG the outstanding events of the month was the meeting in Brisbane of the Australian Agricultural Council, which was attended by the Commonwealth Minister for Commerce and the Ministers for Agriculture of every State. The conference was the most important held since the Council was constituted several years ago. Reviewing its decisions, the Queensland Minister, Hon. Frank W. Bulcock, said that the motive underlying the formation of the council had been the unification of research and the provision of a common approach to economic and agricultural problems.

Three of the decisions were of outstanding interest. The council affirmed that water conservation was a national and not a State matter, and that the necessary inquiry should be made to elevate this question to one involving the co-operation of all the Governments. Allied to this was the problem of fodder conservation, which naturally would follow a sound water policy.

Secondly, the council affirmed its opposition to quotas and to the restriction of production, and expressed a desire that its opinion as the highest deliberative agricultural body in Australia should be sent to the appropriate authorities.

In the third place it declared for co-ordination of research services in relation to stock diseases, and made provision for summoning departmental representatives of the States to lay down a programme for disease prevention and eradication, with special reference to contagious disorders.

The Queensland Council of Agriculture.

ANOTHER important event in August was the annual conference of the Queensland Council of Agriculture, the executive body of the Queensland Producers' Association. The President, Hon. Frank W. Bulcock, in opening the conference, said that economic security was one of the fundamentals of rural organisation. "I am speaking," he continued, "to the farmers of the State through their farmers' parliament. If the farmers realise that the Queensland Producers' Association has the capacity to do things, has the capacity to make representations, and has not only the ear of the Government but also the imprimatur of the Government, I think that talk about the formation of a conflicting organisation that cannot achieve any more than this organisation can achieve, but, on the contrary, will handicap, to a degree, the operations of the organisation by dissipating its energy and total forces, will cease."

Going on to discuss the problems of agriculture generally, Mr. Bulcock added that definite progress had been made during the year in examining and determining the values of available water supplies for water conservation and irrigation. That work had progressed very satisfactorily, and side by side with it a Government committee had been working with representatives of his department, examining every aspect of water conservation and fodder conservation, particularly fodder conservation. This committee had done some remarkably good work.

As Minister for Agriculture, he regarded efficiency as one of the big things underlying all forms of agricultural work. "The people generally," he continued, "never express any resentment at farmer-control or producer-control, but they do say that there is an obligation on the part of the producer and allied interests, to give the Australian market the very best that they are capable of producing. I personally appeal to you to do all that you can to assist the home consumption price by giving the people the utmost efficiency in the production of the products that you desire to sell."

Organised Marketing.

ADDRESSING the delegates to the conference subsequently, Mr. Bulcock recalled his long association with the organisation, remarking that he was chairman of the Parliamentary Agricultural Committee at the time the original Act was before the Queensland Parliament, and that he had continued a sustained association with the entire industry ever since. To-day every country in the world was organising primary producers and tackling their problems along economic as well as cultural lines.

In spite of the opposition they sometimes encountered from inspired sources, neither the public nor the producer would be willing to sacrifice the advantage of organised marketing. The public generally did not realise that marketing boards in Queensland handled millions of pounds per annum, yet the cost of living was lower in Queensland than in any other State of the Commonwealth.

Antagonists so often declared that organised marketing increased the cost of living to the consumer; but rather did it seek to protect the public, and it had succeeded materially in affording the public that protection.

Mr. Bulcock referred to the resolution adopted by the Australian Agricultural Council, composed of Ministers for Agriculture of all the States, which met in Brisbane the same day, affirming its faith in and the necessity for a continuance of organised marketing. This, he said, was one of the most important achievements in regard to organised marketing since the judgment of the Privy Council.

Was it not surprising, the Minister went on, that farming was the only form of human endeavour that so often was denied the right to some form of organisation. The moral right must be greater than the legal right.

Mr. Bulcock added that he was convinced the time was past when there should be rapid changes in the personnel of pool boards. Instead of having a one-year tenure, pool boards should have not less than three years of office, and he hoped before long to have constituted every pool board for a three years' term. This was because he believed that continuity of policy was essential, and because no one could plan a policy and do justice to it and his organisation in one year.

The Romance of Sugar.

IN this issue is published a very interesting account of the development and progress of the Australian sugar industry. The annual report of the Bureau of Sugar Experiment Stations, which was tabled in the Legislative Assembly recently, is equally interesting as a record of contemporary progress in an industry which means so much to the Commonwealth.

No Australian industry is more important than cane sugar production, and, outside Queensland, few are so little known. Its special function in our national economy is not appreciated as widely as it should be. To it is due almost entirely the continued success and stability of the settlement of our tropical lands. Nearly forty per cent. of the area of this continent is situated north of Capricorn. In that vast region are some of our richest agricultural, pastoral, and mineral country. Through sugar, Australian population has increased at a greater ratio in the North than in any other portion of the Commonwealth. The wealth and progress of the thriving cities along the Queensland coast are based largely on sugar. Practically every secondary industry in the State depends on it in one way or another.

Every sugar mill is equipped with machinery made in Australian shops and foundries. Apart from fixed assets, in which many millions of good Australian money has been invested, there are recurring annual replacements of plant supplied by protected secondary industries. As a field for regular rural employment the sugar industry is one of the most extensive in Australia. Added to the vast army it employs in field and factory are the workers in the other industries that look to it as a profitable market for their products; the workers in the transport services; and the workers in the refineries, which are situated in every State capital.

Our sugar business therefore is something more than a simple sum in arithmetic; and the continuance of the industry on a satisfactory basis, and the consequent further development of our tropical lands, are among the bare essentials for the security of Australian hearths and homes.

Codling Moth Control Experiments, 1936-37.

HUBERT JARVIS, Research Officer.

THE need for a satisfactory substitute for lead arsenate in the control of codling moth has been apparent for a considerable time. Various alternative sprays and spray combinations have been used more or less successfully, but lead arsenate, which is both cheap and usually reasonably efficient, is still the most widely used insecticide for this purpose.

In the Stanthorpe district, experiments with non-arsenicals for the control of the codling moth were initiated in 1932 (Jarvis, 1933), and a nicotine sulphate-white oil spray then proved slightly more efficient than lead arsenate, though much more expensive. Subsequent work in the 1933-34 season (Jarvis, 1935) confirmed these experimental results, and also indicated that potash soft soap might have some value as a codling moth insecticide. In the 1935-36 season, the pest was very prevalent, and even where a lead arsenate spray schedule was conscientiously adhered to by the grower, fruit losses were considerable. Hence when the moths are very numerous, lead arsenate is by no means adequate and suffers the further disability that the numerous sprayings necessary, under such conditions, frequently leave undesirable residues which persist on the fruit until harvesting.

In the same season, i.e., 1935-36, it was noted that the addition of a contact insecticide to the lead arsenate spray gave beneficial results. This, in conjunction with the known properties of the nicotine sulphate-white oil combination suggested that further work on spray materials of a non-arsenical nature was justified. Additional evidence in support of this viewpoint was obtained on a plot used for fruit fly control experiments in 1935-36, as some of the sprays, e.g., colloidal sulphur-potash soft soap, incidentally gave quite good control of codling moth. The more promising of these sprays were used in comparative trials during the season 1936-37.

Experimental Material and Methods in 1936-37.

The experimental plot was situated in the Summit area, and comprised thirty apple trees of the Rome Beauty variety, distributed in a single row. The Rome Beauty is a late maturing variety subject to codling moth attacks over a relatively long period. Owing to the irregular incidence of frost damage in the orchard, the crop varied considerably from tree to tree, but the yield averaged two cases per tree.

The season was comparatively dry throughout, though heavy rains fell on and about 12th January.

The thirty trees were equally distributed among nine treatments and a check, allowing for three replications and general randomisation. The treatments were as follows:—

A. Bentonite sulphur-nicotine sulphate—2½ lb. bentonite sulphur: 1 pint nicotine sulphate: 80 gallons water: 2 oz. spreader.

B. Colloidal sulphur-nicotine sulphate—2½ lb. colloidal sulphur: 1 pint nicotine sulphate: 80 gallons water: 2 oz. spreader.

C. Commercial lime sulphur—1 gallon lime sulphur : 50 gallons water : 2 oz. spreader.

D. Commercial lime sulphur-nicotine sulphate—$1\frac{3}{5}$ gallons lime sulphur : 1 pint nicotine sulphate : 80 gallons water : 2 oz. spreader.

E. Thiodiphenylamine—$2\frac{1}{2}$ lb. thiodiphenylamine : 80 gallons water : 2 oz. spreader.

F. Nicotine sulphate-white oil—1 pint nicotine sulphate : 1 gallon white oil : 80 gallons water.

G. Potash soft soap*—10 lb. potash soft soap : 80 gallons water.

H. Lead arsenate—$2\frac{1}{2}$ lb. lead arsenate : 80 gallons water : 2 oz. spreader.

I. Colloidal sulphur-potash soft soap—$2\frac{1}{2}$ lb. colloidal sulphur : 10 lb. potash soft soap : 80 gallons water.

J. Control.

A spreader was used in all sprays other than those containing white oil or potash soft soap.

A lead arsenate calyx spray was applied to all trees other than the controls, the five cover sprays following as indicated in Table I.

TABLE I.

Spray.	Date.	Interval.
		Days.
Calyx spray	21–10–36	
First cover spray	4–11–36	14
Second cover spray	19–11–36	15
Third cover spray	10–12–36	22
Fourth cover spray	4–1–37	25
Fifth cover spray	8–2–37	35
Fruit harvested	5–3–37	25

The experimental trees were kept under more or less continuous observation, windfall fruit being collected each week and examined for codling moth damage. Thus, at the completion of harvesting, every fruit borne by the trees had been inspected and records kept which indicated both the source of loss and, in the case of codling moth injury, the point of larval entry.

At the blossoming period the weather was unusually cold with low night temperatures. The spring brood of codling moths emerging from hibernating larvæ was consequently both late in appearance and comparatively low in numbers. Calyx infestation was small correspondingly, and the following figures indicate that, in fruit which is approaching maturity, grub entrances are mainly at the side and not at the calyx end of the fruit.

	Position of Larval Entry.	
Injured Fruits.	Calyx Entry.	Side Entry.
1,070	216 (20·1 per cent.)	854 (79·9 per cent.)

Spray Injury.

(a) Attributable to Spreader.

The fruit on all the trees treated with sprays in which a spreader was used showed surface spotting which was particularly severe in the case of

* The potash soft soap used in these experiments possessed the following analysis :—

	Per cent.
Fatty anhydrides	46.1
Alkali as Potash (K_2O)	10.4
Alkali as Soda (Na_2O)	.33
Alkali as free caustic	.05
Alkali as free carbonate	2.46
Glycerine	5.2
Water	38.3

thiodiphenylamine and lead arsenate. Comparable spotting was absent on trees treated with sprays devoid of the spreader and also on the controls. It would seem probable that the spreader was to some extent responsible for the damage.

The spots varied in size from 1 millimetre in diameter downwards and were quite superficial. As many as 100 occurred on some fruits, but the blemishes were not serious enough to prejudice the sale of the apples on the Australian market, though badly spotted fruit would not be suitable for export purposes.

The injury may be due to the exceptional qualities of the spreader having facilitated insecticidal penetration through the lenticels. Possibly greater dilutions of the spreader may eliminate the susceptibility of the fruit to spotting without impairing the spreading efficency of the several sprays to any great extent.

(*b*) *Attributable to lead arsenate.*

The trees in the experimental plot, which were treated with lead arsenate in both calyx and cover sprays, all showed signs of leaf scorch, and stood out distinctly from the rest of the plot on this account. Somewhat similar, though much less acute, injury was also noticed in trees sprayed with thiodiphenylamine. In the remainder of the orchard where the lead arsenate schedule was used, scorch was also present on all varieties of apples other than a few trees which, owing to the absence of fruit, were omitted from the spray treatment. Jonathans apparently suffered more severely than other varieties of apple.

During recent years leaf scorch has been increasing in severity in the Stanthorpe district. The trouble has been assigned to various causes, e.g., unfavourable growing conditions and nutrient deficiencies. At the same time the losses caused by codling moth have induced growers to increase not only the frequency but also the strength of the lead arsenate sprays used for the control of the pest. Observations during the current year indicate that in the Stanthorpe district, at least, the amount of lead arsenate required to effect reasonable control of codling moth may be harmful to the trees by producing some form of leaf scorch.

Discussion of Experimental Results.

In interpreting the tabulated results only major differences can be tentatively regarded as significant. Nevertheless, a number of the non-arsenicals gave control as good, if not better, than lead arsenate. Three of these non-arsenicals—bentonite sulphur-nicotine sulphate, colloidal sulphur-nicotine sulphate, and nicotine sulphate-white oil—all possess nicotine sulphate in common. Lime sulphur-nicotine sulphate would be expected to give results comparable with colloidal sulphur-nicotine sulphate, but a single tree, No. 19, in the former series suffered severe damage, and the weighted mean percentage of sound fruit for this treatment is consequently low. The habit of growth in this tree was such that effective spraying was almost impracticable, and it is probable that a repetition of the work would give better results with lime sulphur-nicotine sulphate.

The value of nicotine sulphate in the control of codling moth is further indicated by an examination of the results of the plots treated with lime-sulphur and lime-sulphur-nicotine sulphate. The other constituents in joint sprays containing nicotine sulphate may either supple-

ment the latter by their own insecticidal properties or increase the period over which the nicotine sulphate is effective. Tests with the single and joint sprays in the one experimental scheme are necessary to determine this point.

TABLE II.

EXPERIMENTAL RESULTS.

Treatment.	Total Number of Fruits.	Number Attacked by Codling Moth.	Percentage Unattacked per Tree.	Percentage Unattacked per Treatment.	Approximate Cost per 40 Gallons.
					s. d.
A. Bentonite sulphur — nicotine sulphate	98	0	100		
Tree Nos. 1, 13, 21 ..	80	8	90	93·8	*
	141	12	91·5		
B. Collodial sulphur — nicotine sulphate	59	1	98·3		
Tree Nos. 2, 12, 25 ..	90	6	93·3	94·4	6 0
	295	18	93·9		
C. Lime sulphur	126	61	51·6		
Tree Nos. 3, 15, 23 ..	200	37	81·5	67·7	1 10½
	184	67	63·6		
D. Lime sulphur — nicotine sulphate	58	7	87·9		
Tree Nos. 4, 19, 27 ..	258	105	59·3	73·2	5 2
	128	7	94·5		
E. Thiodiphenylamine	219	38	82·6		
Tree Nos. 5, 18, 29 ..	284	92	67·6	76·7	*
	186	30	83·9		
F. Nicotine sulphate—white oil	74	2	97·3		
Tree Nos. 6, 20, 26 ..	350	3	99·1	98·4	6 1
	407	9	97·8		
G. Potash soft soap	97	5	94·8		
Tree Nos. 7, 11, 30 ..	241	2	99·2	98·0	2 0½
	98	2	98·0		
H. Lead arsenate	167	33	80·2		
Tree Nos. 8, 14, 24 ..	122	31	74·6	84·2	1 6
	369	40	89·2		
I. Colloidal sulphur—potash soft soap	125	2	98·4		
Tree Nos. 9, 16, 28 ..	151	7	95·4	97·0	4 4
	118	3	97·5		
J. Controls.	269	135	49·8		
Tree Nos. 10, 17, 22 ..	344	154	55·2	46·2	—
	208	153	26·4		

*Not available.

Spray costs based on the following prices:—

	s.	*d.*	
Lead arsenate	1	0	per lb.
Lime sulphur	9	0	per 5-gallon tin.
Colloidal sulphur	5	6	per 3 lb.
Potash-soft soap	2	10	per 7 lb.
Nicotine sulphate	27	6	per ½ gallon.
Spreader	3	10	per lb.

A second group of sprays, potash soft soap and colloidal sulphur-potash soft soap, gave excellent results in controlling the pest. The value of potash soft soap is somewhat difficult to explain. Like most soaps, the spray should possess larvicidal and, perhaps, ovicidal properties, while the small amount of free caustic potash may be of value.

The two recognised stomach poisons, lead arsenate and thiodiphenylamine provided reasonable control, the latter being somewhat inferior.

In any spray schedule for the control of codling moth, three considerations are important, viz.:—

1. Residues on the fruit of any kind, toxic or otherwise, are undesirable. Lead arsenate used according to the commoner spray schedules suffers from this disability, and its continued use is largely attributable to its relatively low cost and reasonable efficiency. Washing with various solutions, chiefly a dilute hydrochloric acid bath, is frequently necessary. Of the several sprays used in this experiment only one, bentonite sulphur-nicotine sulphate, left excessive deposits. Even after careful washing the bleached appearance of the surface from which residues had been removed contrasted unpleasantly with the natural colour of the fruit. It is improbable, therefore, that bentonite sulphur-nicotine sulphate, as at present available, can be used to advantage for codling moth control.

2. Joint sprays are sometimes preferable to single purpose sprays. Codling moth is only one source of loss, for both powdery mildew and red mite are apt to be troublesome. Sulphur in some form or other is useful for the control of these, and in an already heavy spray schedule the incorporation of sulphur with an effective insecticide for the control of codling moth is frequently desirable. All the sprays used containing sulphur gave control of both powdery mildew and red mite, while nicotine sulphate-white oil and potash soft soap both adequately controlled red mite.

3. Costs must not be excessive. The cost of insecticides in the spray programme necessitated by codling moth infestation is already considerable, even with a lead arsenate schedule. In Table II. the cost per 40 gallons of the several sprays used for which prices are available is indicated. From a purely codling moth control viewpoint, taking into account both efficiency and cost, potash soft soap is the only spray material which compares at all favourably with lead arsenate. Rather than use a combined spray for this purpose at a much higher cost, it would obviously be preferable to treat the potash soft soap as a single purpose spray, adding sulphur or some such ingredient when the exigencies of the disease situation require it. Costs would thus be kept within reasonable dimensions.

Summary.

1. The experiment was designed to compare various non-arsenical sprays with the lead arsenate schedule for the control of codling moth, all trees receiving an initial lead arsenate calyx spray.

2. The majority of the injured fruits were penetrated by the larvæ at the side and not at the calyx end of the fruit.

3. Superficial injury to the rind of the fruit is attributed to the spreader, and the possible association of leaf scorch with the use of lead arsenate for the control of codling moth is discussed.

4. Five non-arsenical sprays, bentonite sulphur-nictotine sulphate, colloidal sulphur-nicotine sulphate, nicotine sulphate-white oil, potash soft soap and colloidal sulphur-potash soft soap, gave very promising results. Potash soft soap alone compares favourably with lead arsenate so far as price is concerned, and, as colloidal sulphur can conveniently be added when necessary for the control of powdery mildew and red mite, more exhaustive studies of this insecticide will be carried out in the coming season.

P.T.O.

Acknowledgments.

Thanks are tendered to Mr. R. Wells for making available experimental trees on his orchard, and to Mr. Robert Veitch, Director of Plant Industry (Research), for his critical interest in the work.

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HOME-MADE GATE HINGES.

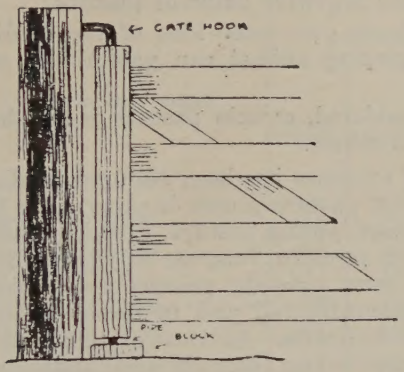

Plate 94.

Two methods of making cheap and effective gate hinges are illustrated. In the first the ordinary gate hook—or a round iron bent to a right angle—is driven into the hingle post with the point downwards. A block on which the gate is to turn is sunk in the ground immediately under this, and is bored to take a short length of ½ inch or ¾ inch piping. The timber joining the hinge end of the gate is also bored

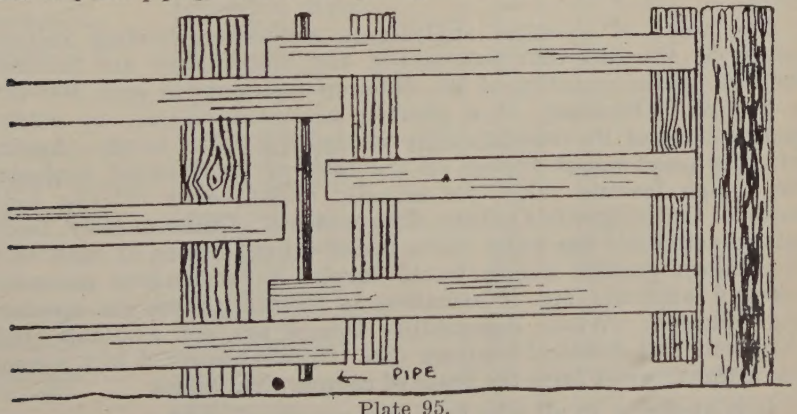

Plate 95.

to receive these irons, ground block is raised to the correct height and rammed after the gate is fitted to the hinges. In the second illustration two rails on both fence and gate are extended and bored to take a length of ¾ inch pipe, which acts as an efficient hinge.

Sown Pastures and their Management.

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[*Continued from p.* 135, *Part* 2, *Vol. XLVIII.—August*, 1937.]

(PART III.)

NUTRITIVE VALUE OF PASTURES.

A SINGLE chemical analysis of a plant is insufficient of itself as a basis on which to estimate the plant's feeding value. The nutritive value of a pasture grass or clover depends upon its palatability, chemical composition, and digestibility, and upon the class of animal to which it is fed. Three generalisations may be made, namely:—

1. The stage of growth and conditions of growth have a marked influence on the nutritive value of pasture.
2. Chemical analyses give some idea of the feeding value, but only through the grazing animal can palatability and digestibility be determined.
3. All things considered, certain pasture plants have a higher nutritive value than others.

A good deal of evidence has been adduced tending to show that the young growth of most pasture plants is superior in feeding value to the mature growth. Short, young pasture, growing under good conditions, is well provided with proteins, fats, carbohydrates, and minerals—all in a highly digestible form. As the pasture grows older the protein and mineral contents generally fall and indigestible fibre increases at the expense of the carbohydrates. In view of this general trend, different plants cannot be compared on their chemical analyses unless the samples represent material of approximately the same stage of growth. Whilst most pasture plants are of higher feeding value when young than when mature, certain plants only become palatable after maturity, and so the young growth is actually of little or no value to stock. The palatability and chemical composition of pasture plants vary with seasonal conditions and with soil fertility as well as with the stage of growth.

The value of chemical analyses in comparing feeding values is lessened by the fact that palatability and digestibility are factors as important as the quantity of the different nutrients in each 100 lb. of the pasture. Obviously, if a plant is neglected entirely by stock as a consequence of its unpalatability its feeding value is nil. Again, a particular plant might appear on the basis of its chemical analysis to have a high feeding value, yet actually might be an inferior fodder because of the indigestible nature of its contents. Unfortunately, feeding trials to determine the exact value under all conditions of each of the better-known pasture plants would involve a tremendous amount of work and expense; but information in regard to certain species is being collected. Where digestibility figures are not available, palatability tests and chemical analyses (the latter interpreted in a common-sense manner) must form the bases of comparative tables.

It is apparent to all who have had experience with various pasture types that some plants (for example, paspalum, Rhodes grass, Kikuyu grass, and lucerne) are of much greater value for feeding purposes generally than are spear grasses, barbed-wire grass, and the like. Feeding trials probably would reveal the fact that plants of the former group

contain a higher proportion of digestible nutrients than those of the latter series, and chemical analyses certainly point that way. Clovers and other legumes of recognised pasture value generally differ from grasses in possessing a higher proportion of proteins in relation to fats and carbohydrates, and a higher proportion of useful minerals.

A very large number of chemical analyses of pasture plants have been made by the Agricultural Chemist of the Department of Agriculture and Stock, and selected analyses are set out in the accompanying table (Table I.). In addition to indicating in some measure the distinctions between various pasture plants, the analyses in many instances show the differences between young growth and mature growth. All the analyses recorded in the table have been made after the water has been removed from the plants by oven-drying.

TABLE I.

Plant.*	Description of Sample.	Analysis of water-free material.				
		Crude Protein.	Crude Fat.	Crude Fibre.	Analysis of ash.	
					Lime.	Phosphoric Acid.
		%	%	%	%	%
Para grass	Young, leafy growth	24·8	0·6	23·2	0·666	0·675
	Mature growth	5·8	1·0	38·0	0·368	0·208
Buffel grass	Young, leafy growth	18·0	1·6	27·0	0·953	0·670
	Stemmy plants	6·1	1·3	37·0	..	..
Rhodes grass	Young, leafy growth	16·4	1·7	27·1	1·199	0·724
	Old, stemmy growth	5·8	1·2	33·3	0·579	0·604
Couch grass	Leafy growth	18·2	1·3	23·5	0·868	0·607
African Star grass	Young, leafy growth (one sample only)	30·1	2·5	18·8	1·184	0·831
Blue couch grass	Leafy growth	18·3	2·0	24·4	0·522	0·776
Woolly finger grass	Leafy growth	20·0	2·1	27·2	0·358	0·628
	Coarse, in full seed	6·5	0·8	37·9	0·236	0·216
Molasses grass	Young growth	11·9	1·4	28·4	0·244	0·239
	Coarse growth after seeding	3·3	0·8	40·8	0·416	0·172
Giant panic grass	Leafy growth	19·2	1·9	19·5	0·542	0·365
	Stemmy material	6·2	0·7	30·4	0·347	0·476
Guinea grass	Young, leafy growth	13·1	0·9	25·8	1·278	0·757
	Old, stemmy growth	4·5	0·6	39·7	0·410	0·148
Paspalum	Short, young grass	20·6	1·6	23·7	0·412	0·618
	Old, stemmy growth	4·1	0·9	41·4	0·239	0·139
Kikuyu grass	Young growth	16·7	1·4	31·2	0·436	0·884
	Growth from old plants	8·8	1·4	27·1	0·416	0·697
Elephant grass	Young shoots	21·0	1·5	23·2	0·764	0·429
	Shoots from 7 feet stalks	7·0	0·7	44·1	0·197	0·081
Cowcane	Young, new growth	12·8	1·1	31·0	1·089	0·731
	First ratoon cane	2·2	0·6	27·6	0·284	0·181
Prairie grass	Short, young grass	29·2	3·6	19·3	1·142	0·827
	Older growth	5·0	1·7	31·9	..	..
Cocksfoot	Short, young grass	24·9	3·4	17·5	0·643	0·365
	Older growth	10·6	3·3	31·0	0·828	0·946
Perennial rye-grass	Short, young grass	21·6	2·9	19·3	1·025	0·954
	Older growth	12·7	1·1	22·3	0·718	0·938
Wimmera rye-grass	Short, young grass	24·7	2·3	19·7	1·014	1·189
	Older growth	6·8	1·7	22·5	..	..
Italian rye-grass	Short, young grass	22·7	1·9	19·9	1·000	0·986
	Older growth	10·6	1·8	20·9	..	..
Phalaris	Short, young grass	25·9	2·9	19·6	0·503	0·338
	Older growth	10·8	3·8	27·7	0·818	1·132
Lucerne	Young, leafy growth	29·4	1·2	17·0	1·979	1·010
	Old, mature growth	18·4	1·2	32·6	3·545	0·679
Townsville lucerne	Young, succulent growth	14·2	1·0	25·9	2·500	0·503
	Older growth	13·5	1·5	32·1	1·534	0·243
Burr medic	Immature growth	29·5	0·9	16·4	1·390	0·991
	Mature growth	28·8	0·9	18·4	1·461	0·948
Black medic	Hay stage	15·5	1·8	18·7	2·391	0·858
Red clover	In flower	23·0	1·7	15·4	3·245	0·756
	Full hay stage	19·0	1·6	17·8	3·540	0·790
White clover	Young, leafy growth	29·9	1·5	16·9	1·569	1·185
	Old growth	18·1	1·5	22·1	2·078	0·528
Wheat	Young, leafy growth	33·0	3·4	19·7	0·836	1·611
	Older growth	10·2	2·7	27·9	0·484	0·721
Oats	Young, leafy growth	33·3	3·1	20·8	..	..
	Older growth	13·3	3·6	26·1	0·715	0·975

* A check list of common and scientific names of the chief pasture plants is contained in a later section.

PERMANENT SUMMER-GROWING GRASSES.

Para Grass (*Brachiaria mutica* Stapf).

Origin and Distribution.—Para grass, also known in Queensland as *Panicum muticum*, panicum, giant couch, or Bancroft grass, is a native of either Brazil or tropical Africa, used extensively in many tropical and sub-tropical countries for grazing and fodder purposes. It was introduced to Queensland about 1880, and is now grown in scattered areas right along the eastern seaboard, which has a moderately heavy to extremely heavy rainfall, and to a slight extent in frost-free areas up to 100 miles from the coast. Para grass can be recommended for use on coastal dairy farms and grazing properties as an adjunct to other cultivated pastures, or as the main cultivated pasture in certain areas, and if planted in damp situations will represent a marked improvement on the usual feed available in such places.

Plate 96.
Para grass, showing habit of growth.

Description.—Para grass (Plate 96) is a rapidly-growing perennial grass with broad, hairy leaves up to 12 inches in length. Its early habit is to produce stout runners which grow along the surface of the ground and form a shallow root system at each joint. Later, upright shoots are developed at the joints and the creeping stems themselves turn upwards. The latter spread very quickly, and the area occupied by the grass rapidly increases in extent and in density of cover. The grass may reach a height of several feet under favourable growing conditions, and usually the stand is so dense that only plants of a similar straggling habit are able to grow in competition with it. Though the grass flowers in Southern Queensland, it is only in the tropics that seedheads are produced in any appreciable quantity. The seedhead has the form of a number of 1-3-inch spikes occurring at irregular intervals along the top 6-9 inches of the seed stalk.

Climatic Requirements.—The distribution of Para grass is a reflection of its climatic requirements. Essentially a grass of the tropics and sub-tropics, it is cut back severely by frosts, and so is less desirable

than certain other grasses for areas subject to low temperatures. In heavy rainfall districts it thrives during the wet season, and is sufficiently drought-resistant to survive (and, in many instances, produce a moderate amount of feed) during the long, dry period experienced on parts of the coast during the autumn, winter, and spring months.

Soils.—Para grass evinces a preference for soils which retain moisture well, and will thrive on waterlogged soils and even in waterholes and streams. On porous soils and on dry and infertile soils it is of little value.

Planting.—Unless it is harvested very carefully, seed of Para grass is likely to be of extremely poor quality and unsuitable for sowing purposes. Sowings of well-filled seed made at the rate of 2 to 3 lb. per acre have in some instances produced good stands. The usual method of propagation is to plant stem cuttings. Each cutting should have two or three joints; and, when planted, at least one joint should be buried in the soil. Rooting takes place at the buried joints, and if the cuttings are planted up to 5 feet apart each way, a good ground cover of runners is quickly obtained on clean land. An alternative method, which might well be used where ample fresh stems are available, is to run out furrows 3 feet apart and scatter mowings or chopped-up pieces of the stems in them covering them with a plough. On fresh scrub burns stem pieces probably would strike if scattered on the ashes during wet weather, but "dibbling-in" is preferable. The grass requires from two to six months to become established sufficiently well to permit of grazing or cutting.

If land intended for Para grass pasture is cultivable it should be ploughed and cultivated in order to provide good soil conditions for the grass. On areas carrying logs or stumps, or which are too wet for ploughing, the grass must be mattocked in. The best time to plant is during the spring or summer months, the actual time depending on the moisture content of the soil and the prospects of seasonal rains.

Though in Queensland Para grass is usually planted in a pure stand, it is reported from various other countries that both the productivity and the feeding value of the pasture may be increased by annual sowings of cowpeas or velvet beans. These legumes are sown when the pasture grass is being planted, and in subsequent years planted in holes made in the sod with a sharp stick, or, better still, broadcasted after a shallow ploughing of the sod.

Management.—Para grass commonly is both grazed and cut for green feed. On farms where only small patches of the grass exist the usual practice is to cut the grass with a hook or scythe, and feed the green material to stock. More extensive areas are used for grazing, but precautions should be taken to prevent damage to the pasture. The runners of the grass must be permitted to secure a firm foothold before the young stand is grazed, and continuous heavy grazing of the pasture must be avoided. Grazings or cuttings should be regulated in such a way that the feed is used before it becomes coarse.

Conservation.—Para grass should be quite suitable for silage purposes, but its use as hay is likely to be small in the wet districts in which it grows best.

Feeding Value.—The palatability of the young growth of Para grass to all classes of stock is high, and its feeding value quite good. The older growth is dry and woody and has a reduced feeding value.

Pests and Diseases.—Comparative freedom from pests and diseases is a feature of Para grass, which renders it of particular value in paspalum areas as an alternative pasture to ergot-susceptible paspalum. A Coccid bug, with which is associated a sooty mould, attacks the young shoots, but does not cause serious damage.

Special Uses.—Para grass may be used for reclaiming boggy areas of land. It also is useful as a soil-binder.

Undesirable Features.—Within recent years Para grass has come to be looked upon with disfavour in certain areas (particularly on the Upper Tweed River in New South Wales), because of its habit of invading irrigation channels and small streams and impeding the flow of water.

The grass may also assume pest proportions on low-lying cultivation lands if steps are not taken to destroy the plants before they have gained a hold on too large an area. Where heavy infestations occur the land can be cleared by hard grazing during a dry spell.

Rhodes Grass (*Chloris Gayana* Kunth.).

Origin and Distribution.—Rivalled in importance only by *Paspalum dilatatum,* Rhodes grass is now grown over a wide area in Queensland and is the chief pasture grass in many districts too dry to support paspalum pastures. It is a native of Southern Africa and has been introduced for pasture purposes to many sub-tropical and warm temper-

Plate 97.
A stand of Rhodes grass in the hay stage.

ate countries. It is understood to have reached Queensland from New South Wales about 1905. It quickly came into favour throughout the Burnett district and on the Atherton Tableland, and was grown as far west as Mitchell, in the Maranoa, by 1912. During the first decade following its introduction to Queensland, Rhodes grass was sown almost entirely on land cleared of softwood scrub or brigalow scrub; but, within the past twenty years, a good deal of fertile forest country has been laid down to it. Since the introduction of the prickly-pear parasite, *Cactoblastis cactorum,* many thousands of acres of reclaimed brigalow scrub country have been brought into economic production by the sowing of Rhodes grass.

Plate 98.
Rhodes grass.

A good deal of Queensland, within the climatic zone satisfactory for Rhodes grass, possesses soils suited to the grass. This includes not only the land at present devoted to dairying but also vast areas of grazing country now carrying native grasses or timber. The extension of the Rhodes grass areas on to grazing properties has now commenced, and a rapid expansion is likely when graziers generally come to realise the increase in carrying capacity which may be obtained by replacing certain native grasses and trees by such a heavy-yielding pasture and hay grass as Rhodes grass.

Description.—Rhodes grass (Plate 98) is a perennial, tufted plant, with erect, leafy flowering stems and spreading surface runners which root at the nodes or joints. So readily are the runners formed that a good ground cover is obtained within a few months of sowing under favourable soil and weather conditions. From each node of the runners are produced leafy stems which may attain a height of over 4 feet. The long flowering stems bear at the top clumps of 10-14 radiating, brownish-green seed spikes.

Climatic Requirements.—Rhodes grass is primarily a summer grower, making most of its growth during the period October to April. The areas best suited to the grass are those receiving an average annual rainfall of between 25 inches and 50 inches, of which most falls during the warmer months of the year. Districts receiving as low an average rainfall as 22 inches per annum may be suitable for Rhodes grass if the distribution of the rainfall is not extremely erratic. Protracted droughts often cause severe damage to Rhodes grass pasture, since the grass is not particularly adapted for drawing on deep-seated water supplies and has poor recuperative powers. Nevertheless, Rhodes grass may be considered fairly drought-resistant. Its resistance to frost injury is not of a high order.

Soils.—Rhodes grass is grown on a variety of soil types, but thrives best on loams, ranging from sandy loams of good-class forest country through red volcanic loams originally carrying softwood scrubs to clay loams of brigalow scrub areas. Light sandy soils and heavy black soils are not so suitable. On the latter type it is difficult to establish the grass satisfactorily.

Planting.—Being a summer-growing plant, Rhodes grass is best sown in the spring or early summer. If sown in the late summer, there is a danger of the young plants being destroyed by early frosts, and, similarly, late frosts may play havoc with very early plantings. Broadcasting by hand is the usual method of distributing the seed. Rhodes grass seed is variable in quality and seldom reaches a high standard of germinability. Occasional samples reach 80 per cent. germination, but many commercial lines fail to reach the standard of 30 per cent. prescribed by the Queensland Pure Seeds Acts. If good-quality seed is sown, 4 to 5 lb. per acre is sufficient to sow, but where there is any doubt as to the germinability heavier sowings, up to twice that quantity per acre, should be made.

Owing to the lack of a suitable pasture legume for sowing in conjunction with it, Rhodes grass is usually sown alone. In many districts light sowings of lucerne could be made in admixture with Rhodes grass, but in cotton-growing areas lucerne is a breeding crop for the destructive corn-ear worm of cotton. Various other legumes are being tested to determine their usefulness in Rhodes grass pastures.

Management.—The general principles of pasture management, as set out in an earlier section, should be applied in the management of Rhodes grass pastures. The pasture areas should be suitably subdivided to allow of short, intermittent grazings of each paddock, and the grazing should be so controlled that each paddock is eaten off when the growth is young and leafy. Hard grazing, particularly on light soils, must be avoided. The scattering of manure lying on the pasture should be regularly carried out wherever a suitable implement can be worked.

The mechanical treatment of Rhodes grass pastures is carried out by some farmers and appears to be productive of good results. Renovation may be carried a stage further by the judicious use of artificial fertilizers, such as superphosphate and sulphate of ammonia. Under heavy stocking conditions any renovation of Rhodes grass pastures by harrowing and top-dressing can be only temporary in nature, and the measures taken must be repeated at frequent intervals if the pasture is to be maintained in a high state of production. The position would be different if the pasture contained a reasonable proportion of legumes, for then top-dressing with superphosphate would be expected to stimulate the growth of the legumes and so indirectly enrich the soil in nitrates, &c.

In the absence of a leguminous element from the Rhodes grass pasture, the rejuvenation of old stands is a less effective means of pasture regeneration than is the sowing-down of fresh pastures following soil improvement. Probably old Rhodes grass land which has been ploughed up and cropped with lucerne for two or three years would sustain a good Rhodes grass pasture for some years following the ploughing-out of the lucerne. Other cropping programmes, with Rhodes grass occupying the land in most years, could be devised.

Conservation.—The fact that Rhodes grass is a valuable hay grass is not recognised sufficiently in Queensland (Plate 97). Provided that the stand is of a good type (that is, containing a preponderance of plants with abundant leaf and slender stems), a useful hay can be made from the grass. The quality of the hay, particularly its palatability, is rather variable, but all classes of stock will eat it without much waste. The yield also is variable, of course, but on fertile soil young stands should provide at least two cuttings, each of 1½ to 2 tons of hay, per annum. In the fairly dry areas in which Rhodes grass is grown largely the hay is easily cured. In most instances it should be in the stack within forty-eight hours of cutting. The last cutting for hay should be made some weeks before the weather becomes really cold, in order to permit of the growth of aftermath suitable for winter grazing. Where frosts are experienced a growth of about 2 feet should be provided for; the upper part of this will be frosted, but the sheltered basal shoots will provide some picking.

In addition to its usefulness as hay, Rhodes grass should be valuable as silage. A yield of from 4 to 6 tons of green material per acre may be expected.

Feeding Value.—As a rule, provided it is cut or grazed before it matures, Rhodes grass is of moderate to high palatability, though in the coastal districts, and on certain types in the drier areas, the plant is often neglected by stock. Its recovery after grazing or cutting is good, particularly so in young stands, provided that the weather conditions

are not adverse. The feeding value of the leafy material of Rhodes grass pastures growing under favourable conditions is excellent, the grass being rich in proteins and other nutrients.

Seed Production.—The bulk of the Rhodes grass seed sold in Queensland is produced within the State and is harvested by hand.

Pests and Diseases.—Rhodes grass pastures fortunately are little affected by pests and diseases. Outbreaks of white grubs of the genus *Rhopœa* have occurred in the southern part of the State on basaltic scrub soils and there is some danger of the pest assuming serious proportions. Red spider occasionally causes slight damage, whilst Coccid injury is of some consequence. Rust is a rare ocurrence.

Special Uses.—On account of its running habit, Rhodes grass is of some value in protecting soil from erosive agencies.

Undesirable Features.—Some farmers hesitate to plant Rhodes grass on land which they intend to use in the future for cultivated crops owing to a fear that its subsequent eradication will prove difficult. This fear, however, is groundless, as Rhodes grass has no underground runners and is destroyed easily by ploughing and ordinary cultivation.

Paspalum (*Paspalum dilatatum* Poiret).

Origin and Distribution.—A native of South America, *Paspalum dilatatum* is now widespread in many tropical and sub-tropical countries and is grown as a secondary pasture grass in a number of temperate areas. It was introduced into New South Wales towards the end of last century and rapidly came into favour in the coastal areas of that State. The grass soon came to be employed in coastal Queensland and has proved useful, especially under irrigation conditions, in Victoria and Western Australia.

Description.—In habit paspalum (Plate 99) is a perennial tufted grass with clustered, erect stems and shortly-creeping rootstocks by means of which a sown pasture of the grass forms a compact sod. The short underground runners are responsible, in a large measure, for the ability of the grass, once established, to survive heavy grazing, since the growing buds are located underground and so escape damage from trampling. Long, broad leaves are produced in abundance from the crown of the plant and sparingly along the flowering stems. If allowed to mature, a pasture of paspalum may reach a height of several feet: but, except on seed areas, it is unwise to permit the grass to grow taller than 12 inches.

Climatic Requirements.—Paspalum is essentially a summer-growing grass and for its full development requires a warm, moist growing season. Conditions on our tropical coast appear, however, to be somewhat unsuited to paspalum, with the result that the main paspalum areas of Queensland are the South, Lower North, and Central North coastlands, the highlands adjacent thereto (Springbrook, Tamborine Mountain, Maleny Plateau, Blackall Range), the Atherton Tableland, and one or two plateau areas west of the coastal ranges. These areas experience an average annual rainfall of over 50 inches, most of which falls during the summer. Paspalum is grown to some extent in lower rainfall areas, chiefly in low, moist situations; but where the rainfall average is below 40 inches per annum paspalum pastures are of minor importance. As a consequence of its moisture and warmth requirements,

the grass makes almost its entire growth between October and May, with the maximum development during the wet months of January, February and March. Whilst it is unable to persist in dry climates, paspalum is capable of surviving fairly protracted periods without rain. Severe frosts destroy the grass, but light frosts merely retard its growth.

Soils.—A feature of paspalum is its fairly high soil fertility requirement. It will not thrive on poor country and should never be sown on other than fertile soils. Fortunately, most of the "scrub" and better-class forest country on which paspalum was sown up to forty years ago was originally very rich in plant foods and so capable of supporting a productive stand of paspalum for many years. Numerous areas, after having been under grass for a long period, have shown signs of a depletion of soil nutrients, and are in need of special renovation measures.

Plate 99.
A paspalum pasture.

Planting.—Paspalum should be sown in the spring or early summer either on fresh scrub burns or on ploughed and worked-down land of high or reasonably high fertility. A seeding rate of 8 to 12 lb. per acre is recommended. During the summer of 1935-36 an extensive outbreak of ergot occurred in paspalum areas throughout Eastern Australia, and this was repeated to a lesser extent in 1936-37; consequently, there is a possibility that much of the seed coming on to the market for the next year or two at least will be ergotised and of low germinating capacity. Buyers, therefore, should be careful in making seed purchases, and in doubtful cases should submit samples to the Department of Agriculture and Stock for examination. Even in the best commercial lines, however, the percentage of formed seed is rarely greater than 70 and the germinating capacity varies considerably with the age of the seed. It will be found generally that seed twelve months after harvest will have matured sufficiently to reach a standard of 30 per cent.

A delayed germination of sowings of immature seed sometimes is responsible for poor establishment; consequently, only good seed should be used. The usual method of sowing is broadcasting by hand and, if

clovers are to be sown, the area should be gone over twice, first scattering the light grass seed and then distributing the "shotty" clover seeds.

Though paspalum is a very aggressive grass, it will permit certain other pasture plants to mix with it. Notable examples are white clover and tick trefoil, the latter being a prostrate summer-growing legume which has spread naturally into coastal pastures. The ability of white clover to mix with paspalum is of great value, since the clover, after remaining dormant throughout the warm months, produces valuable grazing, in many years, from July to November. Red clover also can be grown quite successfully with paspalum, and various summer and winter grasses will exist for a short time in admixture with it. Lespedeza, a valuable summer pasture legume in the South-eastern United States of America, can be established also in paspalum pastures.

Management.—Of the various types of pasture occurring in Queensland, none is better adapted to intensive management than the good paspalum pasture. Efficient subdivision must be carried out first and the best portion of the farm should receive first attention. The extent of subdivision of the area selected depends upon the size of the herd and on pasture conditions. First-class paspalum areas in the best districts could be subdivided advantageously in such a fashion that when the average number of milkers is concentrated on a paddock the rate of stocking is eight beasts to the acre.

For example, paddocks of five acres each would be about the best size on a farm milking forty cows throughout the warm months. Areas of lower productivity would not be subdivided to the same extent; and on many representative farms 10-acre paddocks would not be too large.

The number of paddocks should be six or more, as this will allow each paddock to be grazed for a few days when the paspalum is five to six inches tall and is of high feeding value. Under favourable seasonal conditions, and using six paddocks, paddock No. 1 should be ready for grazing again after the other five have been grazed in rotation; but where there is great risk of droughts or floods, it would be wise to have nine or ten paddocks for rotational grazing purposes. The animal droppings should be spread in each paddock after the grazing has been completed.

The possibility of the recurrence of epidemics of ergot disease, such as those which occurred in 1935-36 and 1936-37, renders the proper management of paspalum pastures a necessity. The formation of seed-heads must be restricted, either by grazing the grass down before the inflorescences emerge or, where practicable, by the use of a mower. When the number of stock is insufficient to keep the grass from seeding, burning may have to be resorted to, in order to destroy mature growth infested with ergot, but other means should be adopted wherever possible.

Paspalum pastures are particularly liable to decline in production because of adverse soil conditions brought about by various causes. If good pastures are to be maintained, a periodical breaking-up of the matted grass, and of the surface soil, is necessary. Special paspalum renovators have been designed for this purpose. The stump-jump type of tine implement is quite effective if sufficient horse power is available. In cases where tines of different sizes may be fitted it is advisable to

renovate in one direction to a depth of 5 or 6 inches with the fine points and then to cross-renovate, using the broader points. Before renovation is commenced it is advisable to mow any long, coarse grass on the area. Renovation by these means not only improves soil conditions but removes loose and dead grass and provides a seed-bed for any seeds which may be broadcast.

On badly matted areas ploughing of the paspalum is a more satisfactory way of reinvigorating the pasture. This should be done during the wet period of late summer, when weather conditions are favourable to the re-establishment of the grass. The land should be ploughed with a mouldboard plough deeply enough to turn the sod on to the side. Shallow ploughing, by turning the slice right over and exposing most of the roots to the air, tends to destroy the paspalum. Following the ploughing, the area should be levelled off with harrows, and seeds of white and red clovers broadcast. Such drastic treatment as the ploughing of the pasture will throw the treated area out of production for some months; but, if the farm is subdivided into small areas, one or two paddocks may be ploughed each year, thus providing for the turning-over of each paspalum paddock once every five or six years. The temporary loss of feed occasioned by severe renovation will be more than compensated for by the improved condition of the pasture during subsequent years.

A renovation by mechanical treatment should be followed by the broadcasting of seeds of white clover and red clover. On most soils the addition of between 1 and 2 cwt. of superphosphate per acre will encourage the development of the legumes.

Within recent years there has been a tendency for coastal dairy farmers to increase the cropped area on their farms. A rotation of maize and other crops (including green manures) and pasture probably would be the best method of farming. The pasture should be permitted to stand for only a very few years at a time. The building-up of the organic matter (or humus) of the soil by green manuring crops, such as cowpeas, appears to be of particular importance in the case of the porous red volcanic soils.

A useful method of adding a certain amount of organic matter to a pasture soil is to permit the grass to grow tall and rot down once in every three years or so.

Conservation.—The conservation of surplus pasture growth for feeding to stock in lean periods is of particular importance in coastal districts, where the difficulty of conserving hay on the farm is acute. Paspalum pasture is very suitable for silage-making purposes, and on well-managed farms the conservation of the excess growth fits into the general farm management. The grass should be cut when in early flower; and, if ergot disease is present, cutting prior to the formation of hard ergots is advisable in order to minimise the danger of poisoning stock fed on the silage.

Feeding Value.—Paspalum is a very palatable grass and is relished by all classes of live stock. The grass has its maximum value for cream production when in the young, leafy stage, and the pastures should be so managed that they are always grazed off in their most nutritive stage.

Pests and Diseases.—The major pest of paspalum in Queensland is the white grub, which causes very serious damage to paspalum pastures on the Atherton Tableland. The grubs are the larvæ of a beetle; and,

if present in sufficient numbers, may ruin a pasture by destroying the underground portions of the plant. Remedial measures are at present being investigated, and farmers in the infested area are advised to procure pamphlet No. 33 of the Division of Entomology and Plant Pathology, Department of Agriculture and Stock, entitled "White Grub Damage to Pastures on the Atherton Tableland," by J. Harold Smith.

The fungus (*Claviceps paspali*) causing ergot in paspalum first appeared in epidemic form in Australia in 1935, and its widespread occurrence has been responsible for serious losses in stock and in dairy production. Details of the life history of the fungus, and of its effect on stock, are contained in separate departmental leaflets, which are available to farmers on request.

Undesirable Features.—In addition to that susceptibility to ergot, paspalum has the disadvantage of being somewhat of a pest on cultivated land. It establishes itself on fallow areas, in lucerne paddocks, &c., from seed transported by various means, and is rather difficult to eradicate.

Kikuyu Grass (*Pennisetum clandestinum* Hochstetter).

Origin and Distribution.—Since its introduction from Africa to Australia in 1919 Kikuyu grass has found considerable favour as a pasture grass for dairy cattle, chiefly in areas of summer rainfall. Because of the failure of the Australian material to set seed, Kikuyu grass has not been so spectacular a success as paspalum or Rhodes grass; yet it is a valuable adjunct to standard dairying pastures throughout Eastern Queensland.

Description.—Kikuyu grass is a summer-growing perennial grass which, under suitable conditions, spreads rapidly over and through the ground by means of running stems. Both the surface runners and the underground stems root freely at the nodes, anchoring the plant firmly in the ground and forming a dense turf which withstands heavy trampling by stock and "rooting" by pigs. The creeping and erect stems carry a large quantity of leaf, and the stems themselves are very succulent. Under favourable conditions, Kikuyu grass makes a very dense growth, often as much as 2 feet in height.

Climatic Requirements.—In Queensland the grass has adapted itself fairly readily to varying climatic conditions. It does best under moist, sub-tropical conditions; but will withstand a considerable amount of cold and remains green in spite of fairly heavy frosts. For this reason it is very valuable for late autumn and early winter grazing. Its drought resistance is fairly good and some success has been obtained on the Darling Downs and throughout the coastal river valleys (Burnett, Brisbane, Fassifern, Logan, &c.). At present it is used chiefly in the moist dairying districts as an alternative or as a supplement to paspalum. Its lower limit of average annual rainfall is about 27 inches.

Soils.—Kikuyu grass spreads most quickly and yields most grazing on loose, rich soils well provided with moisture, and while it may and does provide fair grazing on some less fertile soils of a sandy or clayey nature, a long-lived high-producing stand can only be assured if the grass is planted on fairly rich soils. Kikuyu grass draws heavily on soil nutrients, especially nitrates, and periodical ploughing to improve the soil conditions is desirable. Under special circumstances, the grass is recommended for poorer soils, such as in rough places or as a soil binder to prevent soil erosion.

Planting.—Whilst in some seasons Kikuyu grass flowers freely in Australia, seed is set very sparingly indeed and commercial supplies are not obtainable from that source. Propagating material is obtained by dividing the crowns of well-rooted plants, by cutting the rooted runners into sections, or by making cuttings of the erect stems. Each planting slip need be only a few inches in length but must have one or two nodes. Planting should be carried out during spring or summer. Cultivable land should be ploughed and harrowed and the cuttings planted 3 feet apart in drills run out a similar distance apart. The cuttings are best covered by hoeing earth on to them, leaving about one-third of the length of the cutting protruding from the soil, and the soil is firmed about each cutting by tramping. If a paddock is carrying only a light covering of grass, some farmers give it just a shallow

Plate 100.
Kikuyu grass.

ploughing and plant cuttings in each third or fourth furrow as the ploughing proceeds. This procedure is not desirable on any but the best soils; on medium-class soils it is preferable to build up the soil fertility before planting Kikuyu grass. The grass is often planted for special purposes, such as weed control or erosion control on rough country. The most practicable method of planting is to mattock the cuttings in and tramp the soil firmly around them.

Despite the very vigorous nature of the growth of Kikuyu grass, white clover is able to persist and thrive in association with the grass where soil and climatic conditions are suitable; and seed of white clover should be planted in Kikuyu paddocks on coastal scrub soils.

Management.—Good management of Kikuyu grass pastures involves intermittent grazing and periodical renovation. Judicious grazing, the scattering of manure and the stimulation of clover development, together

with an annual disc harrowing or renovation with a paspalum renovator, will serve to keep the grass from becoming sodbound. If these measures are neglected the pasture will mat and ploughing will be necessary to give fresh life to the grass.

Conservation.—Kikuyu grass is very difficult to cut with the mower and difficult also to cure, so it is not well suited for conservation.

Feeding Value.—The palatability of Kikuyu grass is excellent and its feeding value is of a high order. The leafy portions of the plant, of course, are of the highest feeding value, and the pasture must be managed so as to keep the grass fairly short for the grazing animals. All classes of stock do well on Kikuyu grass pasture and the grass is particularly useful for pig pastures.

Special Uses.—Being a vigorous, smothering plant, Kikuyu grass is useful for planting in bracken-infested country. In addition to retarding the development of the bracken, it encourages stock to work in amongst the fern and trample it down.

Undesirable Features.—Though a valuable pasture grass, Kikuyu grass is liable to become a very troublesome weed if permitted to encroach on cultivation areas. For this reason it should not be planted adjacent to areas likely to be required for cultivation. In wet weather, portions of the grass are often broken off by grazing animals, and such pieces may be carried by the animals' feet to other portions of the farm and become established after having been trampled in. Whenever patches which have commenced in this manner are discovered in proximity to cultivation paddocks, they should be eradicated.

Molasses Grass (*Melinis minutiflora* Beauv.).

Origin and Distribution.—Molasses grass was introduced to Queensland over thirty years ago from tropical South America. It is a native of Africa and is said to have reached South America during slave-trade days. In Queensland it is grown extensively along the tropical eastern coastlands and to some extent on the Atherton Tableland.

Description.—Molasses grass (Plate 101) is a perennial grass of straggling habit, each tuft forming a large number of trailing stems up to five feet long and reaching a height of two feet or more. Under suitable conditions it is a very rapid grower, spreading quickly by means of the creeping stems and smothering out other growth by the dense mat which it forms. The ability of the grass to cover a cleared area quickly, to the exclusion of weeds, makes it very valuable for sowing on burnt-over areas on which weeds usually come away very quickly. Molasses grass has a strong and distinctive smell, due to the presence in the foliage of a volatile oil. In addition, the leaves exude a sticky secretion which is reputed to be repellent, and perhaps fatal, to ticks and mosquitoes. Four forms of the grass occur in Brazil—namely, "red," "white," "negro's hair," and "franeano." Of these, the commonest form grown in Queensland probably is the red.

Climatic Requirements.—The areas to which molasses grass is best suited are the coastal districts north of Rockhampton—that is, the wet tropical region. It stands up to dry weather quite well, but in cool districts it is badly affected by frosts.

Soil Requirements.—Molasses grass does not demand particularly rich soils and does fairly well on forest soils in North Queensland. Even on dry and somewhat infertile soils it is of some value.

Plate 101.
A plant of molasses grass.

Planting.—The seed of molasses grass is extremely light, and if seed of good quality is used a seeding rate of 2 to 4 lb. per acre is ample in most cases. The germination capacity of a large proportion of the commercial seed of molasses grass is not particularly high and a 20 per cent. standard is set by the Pure Seeds Acts. The seed should be sown during spring or summer, either on scrub burns or on cultivated land. Broadcasting by hand is perhaps the best method of distribution. Instead of seeds, stem cuttings may be planted, but the sowing of seed is much less costly.

Molasses grass is generally sown alone, but the addition of from ½ to 1 lb. of seed of Townsville lucerne per acre probably would improve the pasture in many instances.

Management.—Molasses grass has its growing buds above the ground and is consequently unsuited to heavy, continuous grazing conditions. It should be sown in relatively small paddocks and spelled at intervals in order to permit of recovery from the intermittent grazings.

Conservation.—In South America molasses grass is often conserved as hay or as silage, but so far little or nothing has been done along similar lines in Queensland.

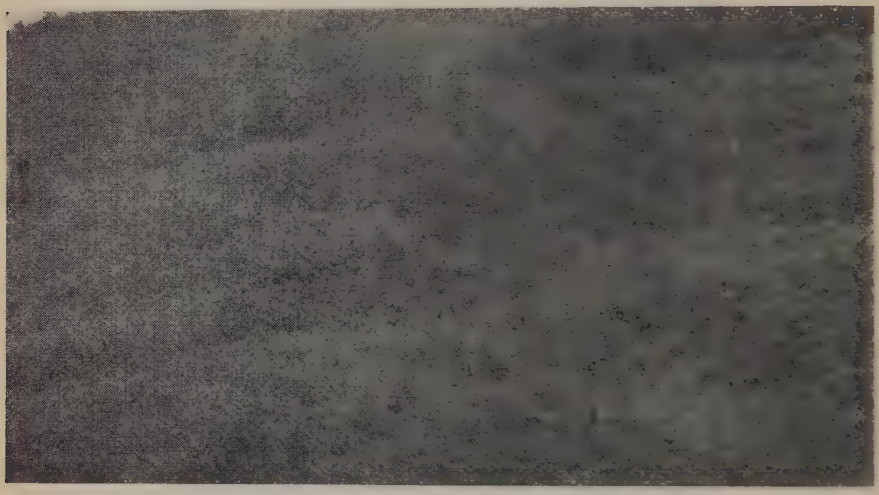


Plate 102.
A molasses grass pasture.

Feeding Value.—Stock at first show a distinct distaste for molasses grass; but, in North Queensland at least, they soon grow accustomed to it and eat it readily enough. Its nutritive value appears to be only moderate for dairy cows, though stock fatten on the grass quite rapidly.

Seed Production.—The poor quality of much of the molasses grass seed on the market may be attributed in part to too early harvesting and heavy threshing. The grass should not be cut for seed until a fair proportion is ripe; and the seed which falls when the cut plants dry will be of good quality.

Pests and Diseases.—No trouble from pests and diseases has been experienced in Queensland.

Giant Panic Grass (*Panicum antidotale* Retz.).

Origin and Distribution.—Giant panic grass, known also as blue panic grass, is native to Southern Asia, and was introduced to Australia many years ago. It is at present grown on small areas in Northern New South Wales and in Southern Queensland. Tests in progress indicate that the grass is likely to find a useful place on grazing properties from the coast to the interior.

Description.—Giant panic grass (Plate 103) is a tufted grass with an exceptionally vigorous rooting system, and forms short, strong

underground stems from which are produced succulent leafy shoots that eventually may develop into cane-like flowering stalks. The underground runners and deeply-penetrating roots enable the grass to withstand heavy feeding and to survive dry conditions.

Climatic Requirements.—Whilst it thrives under fairly heavy summer rainfall conditions, giant panic grass is especially adapted to areas receiving an average annual rainfall of 20 to 40 inches. In such areas it responds well to storm rains during the summer and during the dry autumn remains green longer than most grasses. Heavy frosts cut the grass back, but light frosts do not interfere to a great extent with the production of green shoots from the joints of the stems.

Soils.—Giant panic grass is modest in its soil requirements, being able to thrive on a great variety of soils, ranging from sandy loams to stiff clays. Naturally, it does best on fairly fertile soils.

Plate 103.
Giant panic grass.

Planting.—The grass seeds freely and the seed is of fair germinating capacity. The minimum percentage of germinable seed desirable in commercial seed is 40, and better lines should be obtainable. The seed is small and light, and from 4 to 6 lb. should suffice to seed an acre. The seed may be broadcast by hand or machine, or drilled in, and should be lightly covered. The best time to sow is in the warm months, as the seedlings then become quickly established. The land should be cultivated if the seed-bed is not a fresh scrub burn. The grass can be established readily by means of rooted divisions of the tufts. Since it is as yet only employed on a small scale, giant panic grass is usually sown in a pure stand.

Management.—The management of giant panic pastures should aim at preventing the development of canelike stems, which are of inferior feeding value. The production of basal shoots of high nutritive value should be encouraged by intermittent grazing, which also will serve to restrict the tendency of the plant to grow rank.

Conservation.—It is difficult to obtain a heavy cutting of giant panic grass without including a high proportion of coarse, stemmy material; consequently, the grass is not likely to prove of much value for hay or silage-making purposes.

Feeding Value.—The feeding value of giant panic grass is fairly good, but the nutritive value of a grass is at its highest when the plant is in the young leafy stage, and giant panic should be kept eaten down to prevent the formation of canelike stems. This suggests that the grass should be sown in small enclosed areas upon which stock may be concentrated in numbers sufficiently large to ensure that the grass is eaten at the correct stage.

Seed Production.—Seed is set in fairly large quantities and may be harvested by hand.

Pests and Diseases.—None of its natural enemies cause much trouble to giant panic grass.

Undesirable Features.—An objectionable feature of giant panic grass is its tendency to spread on to areas on which grazing cannot be rigidly controlled, with the consequent danger of production of thickets of the grass to the detriment of grazing areas originally carrying finer grasses.

Guinea Grass (*Panicum maximum* Jacq.).

Origin and Distribution.—A native of Africa, Guinea grass is now naturalised in most wet countries within the tropics, and is used extensively for forage purposes in South America, the West Indies, Africa, the East Indies, South-eastern Asia, &c. It has been established in Queensland for many years and is fairly common under wild and, to a lesser extent, cultivated conditions along the coastal strip.

Description.—Though many different forms of the grass may be recognised, it generally occurs in large tufts from two to five feet in height and does not form a close turf, as do the better-class pasture grasses (Plate 104).

Climatic Requirements.—As may be gathered from a perusal of the list of countries in which it is important, Guinea grass thrives under warm, moist conditions. Its season of growth coincides with the summer wet season and during dry periods it is unproductive. Severe frosts weaken the grass or kill it and its use should be confined to areas free from heavy frosts.

Soils.—In its native country, Guinea grass is found on a wide range of soil types, and in Queensland it is found on railway embankments and on inferior soils as well as on rich country. For pasture purposes its use should be confined to fertile types of soil.

Plantings.—Guinea grass produces numerous seedheads which flower profusely. Little viable seed is set, however, and ripening is uneven. Much of the seed collected, consequently, is of poor germinating capacity and is almost worthless. The only reliable means of

propagating the grass is by planting out rooted pieces of the crowns. These should be set out, spaced two feet apart each way, when rain falls in spring or early summer.

Management.—In most countries in which it is grown Guinea grass is cut and fed to stock in the green state; but, if it is used in small paddocks and grazed intermittently, the trampling of stock should do the pasture little harm.

Plate 104.
Guinea grass.

Conservation.—Guinea grass makes an excellent hay if cut at the flowering stage. The chief difficulty associated with haymaking is the tufted nature of the plant, which often makes mowing difficult.

Feeding Value.—The grass is very palatable to stock, and the young growth has a high feeding value. Nutritive feed is provided also by Guinea grass hay and silage cut at the right stage.

Seed Production.—The unreliability of Guinea grass seed, other than hand-picked material, is a deterrent to the collection of commercial seed.

Undesirable Features.—In various parts of the world (including Queensland) Guinea grass specimens examined for cyanophoric-acid-yielding glucosides have given positive results, but the amount of prussic acid developed probably is insufficient, under normal grazing conditions, to poison stock.

Elephant Grass (*Pennisetum purpureum* Schum.).

Origin and Distribution.—Africa is the native home of elephant grass or, as it is known in most countries, Napier grass. It now is fairly common in various sub-tropical and tropical regions of the world, including South America, the Southern States of America, West Indies, East Indies, and Hawaii. It was introduced to Australia in 1914 and is now used to some extent in New South Wales and Queensland.

Description.—Elephant grass (Plate 105) is a canelike grass usually reaching a height of 7 or 8 feet, but occasionally growing much taller. It forms large tufts which tiller very freely. The main stems at maturity are extremely coarse and hard, but a large amount of palatable leaf is produced and, if the plant is grazed or cut at the correct stage, the hard stems do not develop.

Climatic Requirements.—Though the tropical coast is the most suitable area for elephant grass, it does quite well in many sub-tropical areas and is grown successfully in a large portion of Eastern Queensland. Its growing period coincides with the summer rainy season and little development is made during the winter months or during dry periods in the summer. The grass is very drought-resistant, and quickly produces feed after the breaking of the dry spell. The foliage is injured by frosts, but the underground parts are not damaged seriously.

Soils.—In common with all other heavy-producing grasses, elephant grass requires fertile soil conditions for its best development. Whilst it will produce feed on inferior soils, it is essential that fertile soil conditions should be provided if abundant feed is to be produced. Well-drained alluvials, scrub volcanics, and rich sandy loams are the best types of soils to use.

Planting.—Elephant grass sets seed very rarely in Australia, and the only material available for planting is the stem cuttings or crown divisions. These should be planted during the summer on well-prepared land. The stem pieces used should be cut from hard stems about six months old and each cane should possess four or five nodes. When planting material is abundant the stems can be cut into three-feet lengths and laid end to end in furrows. When cane pieces are used the furrows should be run out about four feet apart, and three or four inches deep, and the canes laid horizontally in the furrow and covered with soil. When root clumps are broken up for planting the pieces should be planted in hills about two feet apart in the row. After it has been planted the grass should be cultivated until it has become well established.

Management.—In most instances where elephant grass is grown on a farm, the area of the stand is very small and the crop usually is cut and fed green in the same way as maize and sorghum. The first cutting is made about three months after the time of planting, when the stems

are four or five feet tall. The plant recovers quickly after having been cut, and three or four cuttings may be obtained in a season. Stems which appear to contain a high percentage of fibre should be chaffed before being fed.

Plate 105.
Elephant grass.

Within recent years extensive grazing areas of elephant grass have been established in Hawaii, and the grass is said to have shown its value definitely as a pasture grass when grazed intermittently. It is estimated that, under suitable growing conditions, one mature head of beef cattle per acre per year can be fattened on the grass.

Conservation.—Elephant grass is in some countries cut for silage, but the forms grown in Queensland appear to be somewhat too woody for this purpose when in the growth stage at which a bulk comparable with that obtainable from sorghums would be available.

Feeding Value.—The feeding value of elephant grass cut in the immature stage compares favourably with that of Sudan grass in respect to protein and minerals, and, as a heavy yield of immature grass can be obtained, elephant grass provides a large bulk of nutritious feed.

Seed Production.—Seed is set occasionally but not profusely enough to warrant collection, particularly as the plant may be propagated quite readily from cuttings, &c.

[TO BE CONTINUED.]

THE APIARY.

With the opening of the earliest spring flowers and the accompanying rise in temperature, the bees begin to collect the small amounts of nectar and pollen thus provided. As the weather becomes warmer the supplies rapidly increase, and the bees are stimulated greatly to build up the colony. Brood-rearing begins as soon as the new supplies come to the hive, and as the first bees emerge they in turn increase the capacity of the colony for brood-rearing, so that with a good queen and other favourable conditions the amount of brood is increased rapidly.

The main object of the work in the spring is to ensure an abundance of bees in time for the coming honey flow, but during early breeding the bees should be disturbed as little as possible. In order to ascertain whether the bees have sufficient stores, the weight can be judged by tilting or lifting the hive, or the size of the cluster may be ascertained, without breaking the propolis which seals the cover, by looking at the combs from below.

On the first examination, which should take place when all danger of frosts is past, the beekeeper should look especially for queenless colonies. If any are found, it is best to unite these with normal colonies if queens are unobtainable. When uniting, two weak colonies should not be placed together, but a weak colony may be united with a strong one. If desired, the number of colonies can be restored later on, by subsequent division. The beekeeper should also examine the stores, for bees require large amounts of food during the spring, and, while they usually obtain considerable nectar outside, it is rarely enough to provide stores for the very rapid rate of breeding that takes place at this time. If food is needed it may be given rapidly in the form of thick sugar syrup, or, what is even better, combs of honey may be provided.

For those who are desirous of increasing their apiaries, this is a good time to purchase additional colonies. Although the prices asked at this time of the year are higher, usually, than those ruling in the autumn months, they may be expected, during normal seasons, to bring in an immediate return.

If it is intended to move colonies of bees to a different site, this is best done during the cooler months. A special ventilated cover is not necessary then owing to the bee population being less numerous, moreover, winter is the bee-keeper's slack period.

To move bees successfully, however, some preparations are necessary. All supers containing honey should be removed from the hives and carried separately, leaving only sufficient honey with the bees to see them to the journey's end. If the frames are self-spacing it is necessary merely to crowd them together and insert two wooden wedges between the outside frame and hive wall. With unspaced frames a pair of notched strips of wood must be cut for each colony. The sticks preserve the essential distance between each frame and in this way prevent crushing the insects. Two 1-inch nails will secure each stick in place at the ends of the frames. The bottom boards and hive covers should be secured with staples driven in the sides and back. One leg of the staple must be driven into the edge of the bottom board or cover as the case may be, and the other into the hive-body. At the close of the day, when the bees are all in, a narrow strip of wire cloth should be bent to a right angle lengthwise and tacked across the entrance so that it is closed securely.

For road travelling, hives should be packed on the motor truck so that the top-bars of the frames are parallel with the axle, as the combs resist the side rocking of the vehicle much better in that position.

H. Hacker.

Cotton Culture.

W. G. WELLS, Director of Cotton Culture and Senior Research Officer.

ALTHOUGH cotton has been grown commercially in Queensland at different times since 1860, the present period of cotton growing originated about 1920 under a system of Federal and State Government guaranteed prices, which induced farmers to try this crop over a wide range of soils and climatic conditions. Many failures resulted, of course, through lack of experience, but it was demonstrated clearly that excellent yields of good quality could be produced over much of the south-eastern portion of the State. Broadly speaking, the most promising results were obtained in the districts lying between the Great Dividing and the coastal ranges, and extending from Beaudesert in the south to the Fitzroy River and adjacent areas in the north, an area of roughly 400 miles long and from 50 to 100 miles wide.

Cotton now has been grown on an extensive scale in these districts for a considerable time, during which a range of climatic and rainfall conditions, varying from the driest season in sixty years to the wettest winter and spring in a similar period, has been experienced. An excellent opportunity thus has been presented to test it under very extreme conditions, and it has been demonstrated that cotton is a very suitable crop for many sections of the south-eastern portion of the State. In fact, it appears to be the most profitable cash crop that can be grown on many soils in most of the districts, and in several of the drier areas it is outstandingly the best.

PRODUCING COTTON.

Although cotton has been demonstrated to be very suitable for many districts, it is not considered advisable to concentrate on growing it under a one-crop system. Like every other agricultural crop, it is subject to failure, and investigations also have shown definitely that growing cotton year after year on the same soil is conducive to diminishing yields. It is recommended strongly, therefore, that cotton be grown in rotation with

fodder and grass crops. As dairying is well established in most of the cotton districts, such crops can be utilised to good advantage. Broadly speaking, it appears desirable especially in the drier areas, that farmers in the sections where cotton can be grown profitably should develop a cropping system whereby cotton will be the main cash crop, and dairying will be engaged in sufficiently to utilise the fodder and grass crops that have to be grown to keep the soils in the proper condition to produce high yields of cotton.

SUITABLE SOILS.

Variations of climate in a season and between seasons make it most difficult to obtain annually the maximum yield of which a soil is capable. It is believed, therefore, that the farmer should endeavour to ascertain the soils on his place which will produce good yields of cotton in several successive seasons rather than the soil which will produce a very high yield in one season and possibly a poor one in another. The cotton section of the Department accordingly has endeavoured to ascertain the soils in each district which will produce good yields under a wide range of climatic conditions, and, generally speaking, it appears that the clay loams overlying a clay subsoil at a depth of one to three feet approach the nearest to this ideal. Grouped under this soil type may be classed the slopes originally under ironbark, in some districts the broad leaf and in others the narrow leaf ironbark being used as the indicator; the lower slopes and flats associated with box trees of good size; the scrub soils of the brigalow series, especially if adjacent to lower slopes originally covered with box or ironbark; and also the brigalow-belah scrub mixture, if not of so low a level as to become waterlogged in a wet season. These soils appear to be very suitable for cotton growing, for in a dry season the clay subsoil holds the moisture up to the lateral and tap root system, while in a very wet season they become partially waterlogged, and therefore retard plant growth sufficiently to prevent excessive development, and yet not restrict the plants too much.

Other soil types which will produce good yields of cotton, but are more subject to crop fluctuations caused by climatic variations, are the rich loams and clay loams of the alluvial flats usually originally covered with blue gums and a mixture of blue gums, Moreton Bay ash, narrow leaf ironbark, and bloodwood. Of these soils the heavier clay loams associated with blue gums, especially if mixed with large box trees, appear to be the most reliable, although on all of them, if properly rotated with grass crops, excellent yields of cotton of good quality can be obtained.

UNSUITABLE SOILS.

The most unsuitable soils appear to be the deep red soils of the soft vine scrub series and the deep sandy loams of the river and creek alluvials. Cotton crops on both types usually are seriously affected by dry conditions and high temperatures owing to the requisite moisture content dropping to levels below the main lateral root system of the plants. Shedding occurs when this happens, and if heavy rains are experienced afterwards excessive growth generally develops, which is often severely attacked by various insect pests, and frequently no yields are obtained. Farmers should study the suitability of their soils very carefully. In some districts, where at first it was thought cotton could not be grown successfully, profitable cotton crops are now obtained, simply by changing over to other soil types which, fortunately, occur on nearly every farm.

Plate 106.

A portion of a 100-acre field in the Callide Valley, Central Queensland, which averaged over 1,500 lb. of seed cotton per acre. Thousands of acres of forests have been cleared in this and other districts of Central and South-eastern Queensland for cotton-growing since 1924.

NEW CULTIVATION EFFECT.

Observations on all soil types throughout the cotton districts have shown that cotton, during the first two or three seasons following the first cultivation of newly broken-up grassland, has produced heavier yields of lint usually than adjacent cultivations on which cotton has been grown successively for a number of years. The explanation appears to be that a better balance of plant food and also much greater penetration of rain, especially storm rains, is obtained in the newer cultivations.

The continuous cultivation of row crops, such as cotton, causes the rapid decomposition of the original organic matter in the soil, consisting of grass roots and stalks, leaves of trees, &c. This decomposition is accompanied by a rapid increase in the readily available form of nitrogen called nitrate nitrogen, which is the product taken up by the plants. Within four years of cultivation after the breaking-up of the grassland the nitrate content of many of the more fertile loams and clay loams of the alluvials and softwood scrubs increases so much in mid-season that the actual contents of the plants, particularly late-sown ones, become so unbalanced as to affect the fruiting habits of the plants, especially in seasons with light rainfall in the spring and early summer, and heavy mid-seasonal rainfall. On fertile alluvial clay loams the initial nitrate content of new cultivations is often only 7 to 15 parts per million parts of soil, while with several seasons of cultivation of cotton crops it rises to 40 and sometimes as much as 60 parts per million.

The decomposition of organic matter which brings about this increase of supply of nitrates seriously affects the pore space of the upper soils. Investigations have shown that in the soils of a nine-year-old cultivation the total amount of carbon is reduced, a unit volume of soil weighs more, the absorption of moisture is decreased, and the surface soils become more compacted, thereby lessening the penetration of storm rains. In one experiment at the Cotton Research Station, following a steady beating storm of 2·46 inches lasting over twenty-five hours, it was ascertained that only 35 per cent. of the rain penetrated in the upper 18 inches of soil in a nine-year-old cultivation in cotton, as compared with 74 per cent. in a two-year-old cultivation in cotton. As the mid-seasonal rainfall is often of a severe beating nature, it is obvious that the cotton crops on the older soils do not receive the fullest possible benefit from such storms.

Studies made of the movement of the nitrates indicate that the more open surface of the newer cultivations may be of decided advantage in respect to the nitrate absorption by the cotton plants. The bulk of the large lateral root system of a cotton plant on the clay loam soils occurs usually in the first 7 inches of soil. As the nitrates are manufactured in this zone, it follows that in an open soil a greater washing-down of the nitrates occurs with the better penetration of the rains. The nitrate content of the soils around the main lateral system therefore would be reduced more often in the newer cultivations in a wet season, which would tend to bring about a better balance of plant food and thus cause the plants to make less rank growth and fruit more heavily.

CROP ROTATIONS.

Obviously new cultivations cannot be brought in continuously, hence it is necessary to ascertain the system of rotation that will keep the soils in a state best suited to the production of high yields of cotton. Rotation experiments carried out at the research station over a series

of years indicate that some gain can be obtained by growing cotton alternately with giant setaria (giant panicum), maize, sorghum, and such fodder crops. Indications have also been obtained that possibly better yields will be produced where cotton is grown following two fodder crops. Another rotation that is proving most successful is one in which Rhodes grass is grown for three seasons on old cotton land, after which cotton is sown for two or three seasons, depending on the fertility of the soils. Analyses of soils where such a rotation has been practised have shown that Rhodes grass reduces the nitrates substantially during the first two years of growth. Illustrations of the suitability of this rotation on scrub soils have been seen in all districts, and it is recommended strongly that all growers test out the value of a Rhodes grass-cotton rotation on their soils. The food value of the Rhodes grass is high for dairy cows, and, in addition, there is less labour involved in growing it for three seasons than would be required for three ordinary fodder crops.

Plate 107.

Rotate Rhodes Grass with Cotton.—The four or five year old unstumped Rhodes grass paddocks should be brought into cultivation for growing cotton. Excellent yields of cotton are obtained on this class of heavy brigalow scrub soil. After three years of cultivation heavy growth is produced in the resowing of Rhodes grass.

Whatever programme is finally followed, it is necessary to have some rotation of crops if the cotton yields are to be profitable. The soil must be kept in the best condition for cotton growing, otherwise highly varying yields caused by seasonal variations and insect attacks, are certain to be obtained. In addition, the rotation of grass and fodder crops with cotton will help materially in controlling weed growth, and thus reduce the cost of production.

SIZE OF AREAS.

At present the area of cotton per farm varies from 1 to 150 acres, with the average ranging from 5 to 10 acres for the smaller farms to 30 and 40 for the larger ones, also a good sprinkling of 60, 80, and 100-acre crops. The most suitable area depends entirely on the system of farming which is followed. When grown in conjunction with dairying the size of the herd and the amount of labour available should decide the acreage

of cotton. The degree of freedom from weed and grass growth also regulates the area—it being much easier to maintain clean tilth on new cultivations than on areas which have been cultivated for years. Generally speaking, the acreage of cotton should be limited to one that can be kept clean and well cultivated under normal conditions.

Where successful results have been obtained regularly it is recommended that the fullest amount of cotton that can be taken care of properly shall be grown, for undoubtedly cotton can yield better returns per acre under favourable conditions than most farm crops. The main point is to select the most suitable soil each season and to plan a system of crop rotations so that there is always an available area in the best condition for cotton growing. Where this system is followed there will be fewer crop failures, the average yield per acre over a series of seasons will be higher, and the cost of production will be less. A greater degree of stability of the whole industry will also be obtained, which is highly important, for a wide fluctuation in the total yield from season to season increases the difficulties of financing, ginning, and marketing.

EQUIPMENT.

When cotton growing was revived in 1920 the crop was produced mostly in the older settled districts where the farms were generally equipped with walking scufflers, one-row planters, and the usual equipment of the small mixed farm. With the expansion of the industry into the newer settlements with larger acreages of soils suitable for cotton, the areas planted by individual growers quickly increased. These growers purchased riding cultivators, two-row planters, three-section harrows, two or more furrow ploughs, &c., and the acreages farmed with such equipment have demonstrated amply how its use lowers the cost of production. It is believed that there should be a more general use of this type of equipment in the older areas, especially in the dairying districts where between the milkings there is only a limited time for farming operations. This is especially true of the wiggle tail type of riding cultivator, with which one man can cultivate 7 to 10 acres a day, as compared to 3½ to 4 acres with the walking scuffler, and, in addition, can do more efficient work, thereby eliminating the necessity for the hoe being used for other than thinning the cotton crop and chipping out odd patches of weeds.

The use of the two-row split-wheel type of combination maize and cotton planter equipped with disc openers is also of decided advantage. A man with a one-horse single-row planter can plant from 4 to 6 acres a day, whereas with a two-horse two-row planter he can plant 10 to 14 acres a day, depending on the speed of his horses and the length of the rows. This is of marked advantage, as over the bulk of the cotton area the spring rains are precarious and frequently planting has to follow a fall of 50 to 60 points of rain. Speed, therefore, is a big factor in obtaining a good germination under such conditions, and the quicker planting is performed the greater the likelihood of success, especially under the drying-out conditions which usually prevail during spring.

Another decided advantage obtained by the use of this type of planter is that the planting is effected more uniformly than with some of the combination planter-cultivators on the market. Having the planting spouts with disc openers just ahead of the wheels tends to insure the spout and the wheel being more in the same plane than where the spout is some distance from the wheel, as in the other types

mentioned. The split-wheel appears to be of the utmost importance where planting is effected following a storm of some 50 to 60 points of rain. The packing action of the rims of the wheel on the sides of the seed rather than on the top insures the seed being in firm moist soil and at the same time leaves a loose mulch on top to reduce evaporation. As the weight of the machine and the driver is borne by the rims which press the soil against the sides of the seed, it can be seen that a decided firming of the seed-bed directly under the seed is also accomplishd, which assists in making contact with the moisture of the subsoil.

Where the acreage to be planted is too small to warrant the purchase of a two-row machine, the grower may secure very good results with some of the single-row split-wheel planters. These machines utilise the same principle in covering the seed, but may be somewhat light for obtaining the same pressing effect around the seed. This can be effected by carrying a partly-filled sack of seed on the back part of the frame.

PREPARATION OF SEED-BED.

The variation of the winter rainfall is one of the biggest problems with which the cotton-growers in this State have to contend. It is of the utmost importance, therefore, that the Queensland cotton-grower should follow the most suitable methods of preparation of the seed-bed. In seasons of good winter and spring rainfall successful results are often obtained with indifferent methods, but over a series of seasons it undoubtedly pays to prepare the seed-bed so as to store up the maximum possible amount of subsoil moisture.

The general results obtained by farmers in all districts and at the cotton research station amply demonstrate the value of preparation of the seed-bed before the occurrence of the usual June rains, or as soon thereafter as possible and before the benefit of the wetting of the surface soils has been lost. In experiments at the research station over a series of seasons it has been shown definitely that a gain of moisture equivalent to at least an inch of rain is obtained in the upper 18 inches of soil, simply by ploughing ahead of the June rains instead of late in July and August. Ploughing before June can seldom be done following cotton, however, and this indicates the advantage to be gained by growing cotton in rotations with crops which can be harvested in time to allow early ploughing.

Where cotton is to follow cotton it is strongly recommended that the old cotton stalks be cut off with a slide cutter (plates 3 and 4) similar to that used in cutting green maize. This machine can be made on the farm and requires only a wooden V-shaped slide and two worn-out crosscut saws. These are ground to a knife edge and holes bored through for bolting the blades to the slide. The bushes should be cut right behind the pickers and then raked up to dry and burn as quickly as possible, after which ploughing should start promptly. In this way the winter rains may be conserved to a marked extent, especially if the ploughed land is cross disc harrowed, as this operation firms the bed and yet leaves it in a good condition to absorb the maximum amount of moisture at the occurrence of the planting rains.

Some growers have practised ploughing under the old stalks, but unless this is done early or rather deeply, an open seed-bed exists at planting time which requires more rain than where the stalks have not been ploughed under. The ploughing under of so much easily

Plate 108.

SLIDE CUTTER.—An adaptation of the old-fashioned maize cutter, for cutting cotton plants. The box at the rear is a guard over two rolling coulters, which serve to steady the machine so that it cuts more efficiently.

Plate 109.

REAR VIEW OF SLIDE CUTTER.—Showing the method of attaching the rolling coulters. These are of decided assistance in steadying the machine, which has a tendency to swing from one row to the other owing to the irregularity of the spacing of the plants.

NOTE.—After the photograph was taken, it was found that a 6-foot blade, instead of three sections of saws, gave better results. Width of saws should clear frame by 3 inches.

Dimensions of machine are as follows:—Length, 10 feet; width at widest point, 7 feet; width of back carriage, 3 feet; length of arms, 8 feet 6 inches; framework, 4 inches by 3 inches (hardwood).

decomposed vegetable matter, especially on fertile alluvial soils, also increases the nitrate content of the soils, and in some districts has enriched them to such an extent that all varieties of cotton tried in recent seasons have made rank growth and failed to produce profitable yields.

Another reason why it is not advisable to plough under the stalks in the Upper Burnett and Central districts is that the pink boll worm attacks the late crop of bolls rather heavily in some seasons. These bolls develop boll rots and are not picked, so the pink boll worms are turned under with the ploughing in of the cotton stalks. Investigations in Egypt have shown that ploughing under bolls containing pink boll worm does not kill the worms, even if the fields are irrigated. In this respect it is advisable to turn the dairy herd into the cotton fields as soon as the crop is harvested, for the cows eat a remarkable lot of the small unpicked bolls and old bolls containing tufts of cotton and diseased locks, thus destroying a considerable amount of insect life.

On new country, or in the first few seasons following Rhodes grass, it does not appear to be so necessary to plough early, as apparently the more open nature of the soil allows of a greater penetration of the June rains. Undoubtedly greater attention should be paid, however, to obtaining early well-prepared seed-beds on old cultivations, for each season considerable acreages are lost, or stands of cotton seriously reduced, through lack of subsoil moisture, although there was ample winter rainfall to supply the same.

DEPTH AND NUMBER OF PLOUGHINGS.

The depth and number of ploughings varies with soil type and climatic conditions. Generally speaking, with the exception of breaking up new cultivations, one ploughing from 5 to 6 inches deep seems to be suitable in most districts. On some of the heavier clay or clay loam soils which tend to set very hard if much winter rainfall is experienced, it is advisable to cross plough early in the spring to loosen up and warm the seed-bed if winter rains have fallen. Late cross ploughing should not be practised if it can be avoided, however, for a lot of moisture is lost with the operation, and in a spring with light planting rains the dry surface soil turned under with the late cross ploughing may not be wet sufficiently to carry the young seedlings through dry spells. Many losses of stand were experienced in the earlier years of this present period of cotton growing, simply because the farmers practised the usual deep ploughing and cross ploughing used in preparing seed-beds for potatoes, sugar-cane, &c. In later years one ploughing of 5 to 6 inches has become more general, and less loss of stand occurs from lack of subsoil moisture.

In general, it is most advisable to plough across a slope on the level contour rather than in a straight line across it or up and down the slope. Studies made in the Callide Valley have shown that contoured ploughing on slopes in the second year after grassland traps all storms recording not over an inch of rain.

FERTILIZERS.

Experiments testing the value of different fertilizers have been carried out over a series of years in different districts and on various soils, but, generally speaking, there has been no clear-cut evidence that there is any economic gain to be realised by using them. The

explanation is not clear, but it is suspected that the limited and variable spring and early summer rainfall is responsible for the lack of results from the tests. Similar results have been obtained in parts of East and South Africa, where the climatic conditions are comparable with those in the cotton areas here.

In some seasons the addition of nitrate of soda as a top dressing on either very poor soils or hard, tight-textured black clays of the open plains type has given increases up to 100 lb. seed cotton per acre, which yielded barely an economic gain. Likewise, on some of the older cultivated scrub soils where the potash content is low, increases up to 80 lb. seed cotton per acre have been obtained from applying 1 cwt sulphate of potash, but this again was barely an economic gain.

The most disappointing results have been obtained where superphosphate and rock phosphate have been used in an endeavour to counteract the effect of excessive amounts of nitrates in the alluvial loams. To date no gains have been obtained by applying even large amounts of superphosphate or rock phosphate, either in the drills before planting or as top dressings when the plants were at different heights.

PLANTING SEED.

All planting seed is saved from only the higher grades of pure seed plots of each variety. After the seed is obtained at the ginnery it is first heated at 140° F. to kill all insect life, and a portion of the stocks are then delinted to remove sufficient fibres to allow of the seed being used in "walking stick" hand maize planters in the new scrub burns, and also in ordinary planters equipped with maize plates.

It is strongly recommended that delinted seed be used except where sowing in the dry soil is contemplated. Experiments at the Research Station have demonstrated that with delinted seed a more even distribution is obtained in the ordinary cotton planter, and a lighter rate of seeding can be used—12 lb. of delinted seed giving a germination of 3·7 to 4 plants per row foot, whereas 15 or more lb. of undelinted seed would be required for such a stand. It is recommended, however, that a slightly heavier rate of sowing be used on new cultivations or following fodder crops, for the more open soils will dry out sooner in the upper surface and possibly reduce the amount of germination. A quicker germination is also obtained with delinted seed, as shown in the following data obtained at the Research Station:—

TABLE I.

Seed.	Sixth Day.	Seventh Day.	Eighth Day.	Ninth Day.	Tenth Day.	Eleventh Day.	Twelfth Day.	Plants.
	%	%	%	%	%	%	%	per ft.
Delinted ..	49·1	65·2	69·4	72·4	73·8	75·2	76·3	4·5
Undelinted	7·9	25·7	33·9	40·9	44·9	49·6	52·3	2·0

It is not recommended that delinted seed be sown in dry plantings, for, owing to the ability to absorb moisture better than the undelinted seed, light showers will start germination, and if sufficient rain does not fall the seed will rot, whereas the undelinted seed would be unaffected.

TIME OF PLANTING.

The most suitable time of planting in the cotton districts south of and adjacent to Rockhampton appears to be associated with the soil types. On old cultivations of fertile alluvial loams and clay loams, and on the average of the scrub soils, the best results over a series of seasons have been obtained from plantings made during late September and the first half of October in the Central District, and the latter half of October in the Southern districts. On old cultivations on the heavier clay loam slopes of the forest series plantings up to mid-November can be made with good prospects of obtaining highly profitable yields. Likewise, plantings can be made later on new cultivations on all soil types; several instances of early December planting have been reported as having yielded excellently. No advantage appears to be obtained by planting in August or early in September, even if climatic conditions are favourable, for the low soil temperatures retard germination, and later rains chill the young seedlings so much that usually early October plantings catch up with them, and often have a much better stand. In some seasons a very heavy loss of terminals occurs in the early September plantings through insect attacks, while later plantings suffer much less damage.

METHOD OF PLANTING.

Several methods of planting cotton seed are used in this State, all of which give good results when favourable conditions exist. In most districts, however, it is believed that the best results will be obtained by waiting until good planting rains occur, harrowing to make a nice mulch, and then planting with a split-wheel type of planter equipped with disc openers. The harrowing not only warms the soil and thus hastens germination, but also checks an early growth of grass and weed seedlings, which is of marked advantage in reducing the costs of cultivation. Undoubtedly this is an important point and one which is not receiving sufficient attention by many farmers. The harrowing before planting is particularly necessary when cotton follows Rhodes grass, for if not done then the grass seedlings germinate with the cotton and soon require hand-chipping.

Growers planting large acreages of cotton are faced with the problem of getting their crops sown so that they will obtain the fullest benefit from the spring rains. As these seldom occur in more than 2-inch storms, and often lighter, it is frequently impossible to get planted on the one storm unless considerable equipment is available. Some growers therefore plant all their acreage in the dry soil prior to the spring rains; others plant half in the dry and half following the first good rains, while others plant as much as the soil moisture will allow following the first rain, and then wait for further rains to complete their plantings, The latter system is preferable in some respects, for it distributes the future operations over a longer period and thus eliminates a peak demand for a large amount of labour in any of the larger cotton districts. The spring rainfall is most uncertain, however, and it is advisable to take full advantage of any rains occurring. It is believed, therefore, that the system of planting a portion of the acreage in the dry and the rest after good rains occur is the best. The proportions depend on the equipment available. Usually sufficient rain falls to allow of planting for at least three days under satisfactory germinating conditions. By planting in the dry all but the acreage that can be handled in three days it is possible to obtain a highly satisfactory strike over a large acreage from the one rain. It

is pointed out, however, that the dry planting should be harrowed as quickly as possible after the rain, in order to eliminate weed and grass seedling growth, especially if the germinating rains do not occur until late October or November. The cotton seed will germinate quickly then, and any delay in harrowing may destroy some of the cotton seedlings. It undoubtedly is advisable to harrow the dry planted portion, for each season witnesses growers increasing their cost of cultivation simply through omitting this early harrowing. Dry planting has drawbacks, however, in that in some seasons much loss of seed is experienced through the spring showers being just enough to germinate the seed, after which there are no following storms to establish the seedlings. In wet springs severe crusting of the heavy soils occurs, often in the dry planted areas, even if harrowing is done, and frequently no strike is obtained or one just good enough to influence the growers to leave it, although the stand is not sufficient to allow of the soil producing the maximum possible yield. The problem is a difficult one, and the general district experiences for each soil type are the best indicators of the merits of each method.

Many growers of small acreages in the older agricultural districts, who have maize planters unsuited for planting undelinted cotton seed, have adopted the practice of opening shallow furrows, sowing the seed by hand, and then covering with either a harrow or scuffler. This system undoubtedly causes loss of moisture and undoes the benefit obtained from an early preparation of the seed-bed. It is suggested, now that delinted seed can be obtained, that where an ordinary one or two row maize planter is available, the plates be modified to make them suitable for planting cotton seed. This can be done by enlarging the holes in the six-holed plates and adjusting the gears to allow of the proper rate of seeding.

The provision of delinted seed is of great assistance to the growers in the newly burned scrub areas, for it eliminates the necessity of treating the seed to make it suitable for using in the "walking stick" hand planters. There may be some danger, however, in sowing the delinted seed in the dry ash before the planting rains occur, on account of the delinted seed germinating with less rainfall than would be the case with treated seed; hence in a spring experiencing light showery conditions considerable replanting might be necessary. It is suggested, therefore, that a grower plant only a portion of his scrub acreage in the dry ash until sufficient experience has been obtained to demonstrate the degree of danger associated with such a practice in each of his soil types.

DEPTH OF SOWING.

The correct depth of sowing varies between 1½ and 2½ inches, depending on the condition of the seed-bed, amount of moisture in the surface soil, and the method of planting. The main objective is to get a good stand as quickly as possible. This requires planting the seed just deeply enough to have sufficient moisture to germinate them, and still not have the soil dry out before the young roots penetrate into the moist subsoil. For most soils under average conditions a depth of about 2 inches in moist, firm soil will allow of a good germination being obtained. This is especially true if a split-wheel type of planter is used. Where the seed is covered by scrapers, or by scufflers if planted in shallow furrows, 2½ inches will probably be better, as the soil is not compacted and there is a danger of the moisture being lost before germination is effected, particularly if drying winds are experienced.

If plantings are made at a greater depth than 2½ inches there is always a danger of the seed rotting in a cold wet spring, and in a dry spring, while germinations may be obtained, the seedlings are frequently so long in coming through the surface that they are thin and spindly and of a pale yellowish colour rather than the usual healthy green. Such weakened seedlings are likely to be attacked by diseases if wet weather is experienced subsequently, and may wither if hot, dry winds prevail for any length of time. Generally speaking, the tendency is to plant too deeply, especially in the plantings in September and early October, when the soil temperatures necessitate quick germination and an early appearance of the seedlings above ground.

SPACING OF ROWS.

A spacing of 4½ feet between the rows is generally used in all the cotton-growing areas. Widths varying from 3½ to 5½ feet were used at first, but experiments and the general experience of growers indicate that around 4½ feet appears to be a fairly good row spacing for most soils over a series of seasons. It is possible, however, that where cotton is being grown on the clay loam forest slopes away from the immediate coastal areas, a spacing of 4 feet or 4 feet 3 inches may be suitable. Usually the plants do not grow so tall on such soils as on the alluvials; hence under moderate rainfall, ample sunlight and air movement may be obtained with the closer distances.

It is not recommended that spacings smaller than these be tried, for with heavy rainfall accompanied by prolonged cloudy weather in February there is a grave danger of a growth sufficiently rank being made to create dense shade. Experiences of past seasons have indicated that such conditions are conducive to insect attacks, accompanied by heavy losses from boll rots on the lower portions of the plants.

CULTIVATION.

It is recommended strongly that proper attention should be given to the cultivation of the cotton crops during the early stages of growth. The general tendency is to wait until the plants are 4 to 5 inches tall before the first cultivation is made. In most seasons considerable development of pigweeds and summer grass will be present by then, especially when early showers are experienced, and it will be nearly impossible to destroy all such growth without hand labour, even with the most efficient cultivators. This not only increases the cost of production needlessly; but, where only light rainfall has been experienced, moisture has been robbed from the soil around the plants which should have been conserved by careful mulching and clean cultivation. The practice at the Cotton Research Station is to harrow after the rain before planting and cultivate close to the row as soon as the seedlings are 2 or 3 inches high, using a riding cultivator equipped with tines 2½ inches wide, and guards to prevent the soil covering the plants. This eradicates all weed and grass seedlings, establishes a nice mulch around the plants, and helps to prevent any further growth of weeds in the row. If rainfall is experienced before thinning time, it will be necessary to cultivate again, especially on old cultivations, otherwise this can be avoided until the thinning is done. A careful cultivation is given after thinning to re-establish the mulch between the rows and around the plants. This should be done as soon as possible on account of the removal of much of the mulch in the row during "chopping" operations, as the thinning with a hoe is termed.

Generally speaking, not more than three or four cultivations should be required after the one immediately following the thinning if cotton is grown in rotation with Rhodes grass; on old cultivations as many as ten may be required. At each of these operations it is recommended that the soil be worked to the plants, for not only does this help to control weed and grass growth but a firm brace is established around the plants which assists in preventing them from being blown over during severe storms when the soil is wet.

The greatest efficiency should be obtained in the cultivation operations. For most districts it is recommended that the best work can be done with the two-row cultivator of the type in which the driver steers with his feet the carriage on which the tines are fastened, rather than depending entirely on being able to guide the horses. There are several makes of this type of machine on the market, all of which can be equipped with tines, sweeps, duck feet, and in some cases discs. By using such a type of machine not only can better work be done close to the plants, thereby avoiding the necessity of much hand hoeing of the crop, but a greater acreage can be cultivated in a day, thus reducing the cost of production in two ways.

Plate 110.

Illustrating efficient cultivation. The plants in the foreground are velvet bean seedlings, which are very brittle, yet with the equipment being used no damage was done to them. The soil is of a clayey nature and the cultivating is being done three days after a heavy downpour.

It is advisable to continue the cultivation as late as possible, for with the beating nature of the usual mid-seasonal storms, a very large amount of the rainfall runs off the compacted soils, especially in the older cultivations. Soil moisture determinations at the Research Station

in 1932-33 demonstrated that following a long dry spell a storm of 2·94 inches—occurring in two falls, one late in the evening and the other early next morning—failed to increase the moisture content of the soil in the 4 to 6-inch level on non-mulched old cultivation. Late cultivation must be maintained to allow of as much penetration of storm rains as is possible to obtain. With a one-row scuffler very tall cotton can be cultivated by using long traces and a spreader close behind the horse, with the ends of the spreader wrapped with hessian to protect the branches of the plants. Little damage is done in tall cotton cultivated in this manner, and the destruction of weed growth and establishment of a mulch in the "middles" is of marked assistance in developing the late middle crop of bolls in an ordinary season. If the last cultivation is made when the surface soil is dry and crusted enough to break up in clods, it will be all the better for retarding the run-off of storms.

HEIGHT OF THINNING.

The question of what is the proper height of plant at which cotton should be thinned is very important under Queensland conditions, for with the light rains that are often experienced in the spring, competition for moisture becomes very acute in unthinned cotton. On the other hand, several different insect pests attack the terminals of the cotton seedlings early in their growth and the growers are loath to thin too early, especially in seasons when cutworms are present in large numbers, for fear of losing their stand of well-formed plants after thinning.

Experiments conducted at the Cotton Research Station, while yielding varying results, indicate that thinning when the plants are 6 to 8 inches tall can be expected to yield better than do later thinnings. Apparently thinning at this height is conducive to the formation of fruiting branches low on the plant, which allows of the early flowering, setting, and maturing of the crop. Indications have also been obtained that there is a tendency to produce more five-locked bolls, thus increasing the average weight of boll per plant.

Many cotton growers are dairying as well, and therefore have but limited time between milkings for field work. It is believed, where a large acreage is being grown and the thinning has to be done without employment of labour, that it is better to start operations when the plants are 4 to 6 inches tall, for this is the easiest height at which to thin, and the chances of completing the thinning before the plants are too tall will be increased. The same suggestion applies where labour is employed by contract thinning in the large areas. Thinning when the plants are from 4 to 8 inches tall enables the men to cover a greater acreage a day, and thus allows of the cost of thinning being kept at an economic level.

METHOD OF THINNING.

Opinion is somewhat divided in Queensland regarding the necessity of thinning. Some growers maintain that a light planting of delinted seed, which the ordinary cotton planter distributes fairly uniformly spaced in either singles or scattered bunches—a 9 to 10 lb. rate of sowing averaging from 2 to 3 seed per row foot—gives satisfactory results. Others sow about 15 lb. of delinted seed and then cross-harrow when the seedlings are 3 to 4 inches tall, which tends to knock out thick bunches and leave a fairly uniformly spaced thin stand. Most of the

growers believe, however, in thinning out to wider distances with the hoe, and where this is done a greater rate of thinning could be accomplished if more attention were paid to the use of the right type of hoe. One frequently sees heavy chipping hoes with clumsy, twisted sapling handles used in thinning or "chopping" cotton. It is difficult to do skilled chopping with such an implement, and it is recommended that a light type of goose-neck garden hoe be used instead. Not only can the strokes be guided more accurately when using the lighter hoe, but they can be made with much less fatigue, which will result in a greater acreage of chopping per day.

The angle of the set of the blade to the handle of a hoe is most important, as a hoe suitable to a tall man is not at all suitable to a short one, for in chopping cotton the art lies in cutting off the plants cleanly at the surface of the ground with the least effort. A blade set at too acute an angle tends to split the stalks rather than cut them off cleanly, while, if set too close to a right angle, it tends to enter the soil too deeply and requires very accurate guiding. The cutting edge should be kept well sharpened with a file, especially on the corners, which play a very important part in skilled chopping. Greater attention to what may appear to be minor points undoubtedly increases the efficiency of cotton chopping.

Experiments have been carried out with a cotton thinning machine of the oscillating chopping blade type, but not very successful results have been accomplished with it. Cultivators equipped with discs have also been tried and have given fair results. Machines similar to low two-wheeled orchard cultivators have been designed in the United States, and reports indicate that up to 20 acres a day can be thinned out in bunches by cross cultivating with them. Where an orchard cultivator with 8-inch duck feet is available, it should be experimented with, for any machine which will thin the plants into bunches spaced to the distance desired reduces the cost of thinning appreciably, as a final stand of one plant per bunch is then cheaply obtained with a hoe.

DISTANCE BETWEEN PLANTS.

The best distance to space the plants when thinning depends, broadly speaking, on the height they are likely eventually to reach. Where the plants generally grow to a height not exceeding 3 feet, they can be left closer together than where they normally grow to 4½ to 6 feet tall. Unfortunately, variable seasonal conditions affect the results obtained at all spacings, so that the best distance to space the plants narrows down to the one giving the greatest factor of safety in each soil type under a wide range of climatic conditions. This varies with varieties—those of more open habit of growth standing closer spacing than the ones with large leaves and coarser vegetative development. Generally speaking, however, 12 to 18 inches can be depended on for the spacings on the soils where the more open plant growth is made, while 18 to 24 inches appear to do better over a series of years where taller growth is generally experienced. Closer spacings on the poorer soils may sometimes produce heavier yields, but there is always a danger of the size of the bolls and quality of the fibre being affected by moisture shortage during dry periods of high temperatures. Undoubtedly a lot of weak and wasty fibre is produced each season through the growers not spacing out their crops sufficiently to enable the plants to withstand adverse conditions.

Another point against spacing too closely is that under excessively wet mid-seasonal conditions rank growth is likely to develop in all varieties on many of the cotton-growing soils of this State. Such growth is accompanied nearly always by excess shade, which is very attractive to various kinds of insects injurious to the cotton crops. Most of these pests either destroy the bolls or puncture them so badly that internal boll rots, which are also increased under conditions of shade and high humidity, attack the crop and cause either entire loss of the boll or serious staining and weakening of the fibres. An open airy surrounding for each plant is highly desirable under Queensland conditions, and the spacing problem is to obtain this to the fullest extent without sacrificing too much row space between the plants. It is recommended, therefore, that the abovementioned distances be used for the general spacing until it can be ascertained if others are more suitable for the particular type of soil being used.

HARVESTING COTTON.

The harvesting of cotton is the most expensive item in the production of this crop, and the way in which the crop is harvested has a decided effect on the quality of the lint produced.

One of the most important points to observe is that cotton should not be picked either when it is wet from exposure to rain, or when it is green, as fibres are called before the bolls have been open long enough to allow the fibres to dry out thoroughly. Not only is it difficult to clean leaf and trash out of cotton in either condition, but during the ginning operations the saws cut the wet fibres very badly, and also tend to leave them in a twisted, ropy state. Lint of this nature is easily detected, and the buyers penalise it heavily, for much waste is obtained from such cotton during the spinning operations. Picking may be done while the dew is still present, but the cotton should be spread out in the sun to dry during the forenoon, after which it can be baled with the rest of the picking of the day. It is not necessary to dry the cotton which is picked after the dew is off, providing "green" cotton is not included.

PRESERVING THE "BLOOM" OF THE CROP.

Another important point when harvesting cotton is to guard against leaving the cotton exposed too long to the weather. Cotton, when the bolls first open, has a nice richness of colour, or "bloom" as it is termed, and it is necessary for a sample of cotton to have this "bloom" before it can be graded into the higher grades of the regular universal standards, although it may be free of trash. When cotton is left unpicked for several weeks the bloom is lost through the bleaching action brought about by the nightly wetting with the dews and the subsequent drying by the sun. This changes the colour to a chalky dead-white and also destroys the lustre of the fibres. The effect of storms on cotton is worse than the dews—the colour is changed to a dull greyish tinge, and even to a light bluish tinge when rains lasting several days are experienced. When rains do occur cotton should not be picked until several days of sunshine have been experienced, in order that the dews and sun may bleach out the stains, and the wind and heat fluff out the fibres from the matted condition caused by the rain. This greatly improves the appearance of the lint, and raises both the lint and seed cotton at least a half-grade. A benefit is thus

obtained in two ways by delaying picking after a storm until the cotton has improved in appearance—the cotton is of greater value, and no payment is made for picking moisture.

EFFECT OF HIGH WINDS.

The picking of cotton also should not be delayed too long on account of the effect of strong winds. With the continuous movement of the plants in windy weather the locks tend to hang out of the bolls in a long, stringy condition. This not only allows the cotton to dry out excessively, thus losing weight and adversely affecting the character of the fibres, but also makes the seed cotton difficult to gin properly, owing to a considerable proportion of the locks being in a twisted, rope-like condition which gathers up bits of broken bracts and leaves in windy weather, especially if severe frosts have occurred. It is difficult to clean such trash in the ginneries, for the smaller pieces are generally twisted in amongst the fibres. In addition to these disadvantages, much greater loss of crop on to the ground occurs in wind-blown cotton during heavy storms than where picking is done at proper intervals. It can be appreciated, therefore, that cotton should not be left unpicked too long. Where the harvesting is done by the grower and his family it will pay to make several pickings in a good crop, depending on the season. Where labour is employed it has to be remembered that sufficient bolls must be open to allow the picker to make a reasonable tally, otherwise the cost of picking necessarily will be higher. Generally speaking, it has been found satisfactory when employing labour to make one good picking and then a clean-up in fields of light to medium yield, and two pickings and a clean-up in good crops.

HOW TO PICK.

Picking can be done best by using both hands working independently of each other, but guided by eye each time. This enables one to fill both hands before emptying into the sack and saves an amazing number of movements during the day. Generally a sack is strapped around the waist so that the weight of the cotton is on the ground and the mouth of the sack hangs open, thus enabling the cotton to be put in quickly. With the modern cleaning machinery installed at the ginneries it is not necessary to pick only clean cotton, for a certain amount of the bracts, the leaf-like parts surrounding the boll, may be included, provided they are not in twisted cotton, as they are removed in the cleaning machinery before the cotton is ginned. The amount of stained cotton should be kept to the lowest minimum, however, for the stained fibres are much softer and weaker and are cut up in the ginning, while their colour lowers the value of the rest of the lint. The hard, diseased locks should not be included, for these are so much waste for which the grower pays picking charges, and the Cotton Pool pays freight—the grower thereby losing in two ways. Cotton containing these hard locks has to be graded low, for a certain amount of the softer diseased ones are ginned with the good cotton, thereby lowering the value and thus making a third loss to the grower.

The most difficult matter to remove from the cotton lint is grass and weed seed, especially spear grass seed, and every effort should be made to clean the fields at the last cultivation so that no seed will be produced. On old cultivations, even where good farming practices have

been followed, there is always danger of tall-growing weeds in the rows setting seed late in the season, and it pays to chop out such weeds before the harvesting commences, especially if pickers are employed.

SNAPPING.

Cleaning machinery is installed at the Glenmore and Whinstanes ginneries for treating snapped cotton. Snapped cotton is obtained by snapping or jerking the whole burr and contents from the plant, and should be practised only after heavy frosts have been experienced. Snapping unfrosted bolls tears the plant badly, and the cotton when packed in containers for forwarding to the ginnery "sweats" so that it is difficult to clean and gin. In addition to this, freight is paid for the green sappy burrs, leaves, and portions of the plant instead of light, dead material. Snapping undoubtedly lowers the grade of most of the mature cotton of high quality to the point where the full value of the lint cannot be obtained. On the other hand, snapping the top crop of bolls, which usually contain cotton of lower quality, not only does not lessen the value materially, but enables a considerable amount of cotton to be harvested cheaply which would often not be picked in the ordinary manner. Only bolls containing marketable cotton should be snapped, however, for the dry, hard diseased bolls, or "hickory nuts," as they have been termed, contain no cotton, and are removed in the cleaning machinery before the seed cotton is weighed, while the weak and wasty fibres of partially developed bolls are so badly gin-cut as to lower the quality of the whole bale. Under no circumstances should wet or even damp-snapped cotton be forwarded to the ginnery, for only lint of the lowest grades can be obtained from it, as the big pieces of moist bracts become so entangled in the fibre that the cleaning machinery cannot remove them. Snapping is of value to Queensland cotton growers, but should be used properly.

PACKING COTTON.

Owing to the distance of the cotton fields from the ginneries in Queensland the crop is forwarded by train either in bags or wool packs containing around 80 to 100 lb. and 500 lb. of seed cotton, respectively. The growers of small acreages generally use second-hand chaff-bags, &c., while those with more than 5 or 6 acres usually purchase once-used wool packs for their crop. It is cheaper to use the wool packs, for grower's individual ones are returned for a small fee which covers cost of freight and heating to kill the pink boll worm or any cotton pests in them, whereas the bags are not, and thus represent a loss to the grower.

CLEAN CONTAINERS NECESSARY.

Before filling a container it should be cleaned carefully to remove everything that might affect the grade of the cotton, and wool packs which have had cotton in them should be cleaned especially in order to protect the purity of seed. Growers should pay particular attention to this feature, for undoubtedly much contamination of pure seed varieties can be brought about by admixture caused through bits of seed cotton sticking in the corners of bales and being attached to strands of the sewings along the edges.

UNIFORMITY OF GRADE IN EVERY BALE.

When packing a container every care should be taken to have only the one grade and staple of cotton in it. A bale of lint is sold

on the basis that it contains cotton of uniform grade and staple length. If there is any variation of content encountered it is purchased on the basis of the lowest grade and shortest staple contained. It is most important, therefore, that growers should pay careful attention to forwarding containers with uniform contents, and it is strongly recommended that some effort be made to grade the cotton before putting it into bags. Usually two, and in some fields, three grades should be ample, for with the exception of droughty spots or places of rank growth, the quality of the crop over a field, if picked in a short time, is more or less the same. By having a bale each for good grade; leafy cotton; and cotton which is insect stained or from droughty parts in the field, a grower, especially with a large acreage, would not only obtain the full value of his crop, but would be forwarding containers of uniform contents, thereby assisting the industry generally.

Plate 111.

PACKING COTTON.—A baling centre in the field. A once-used wool pack is suspended by plain fencing wire and the cotton tramped in until approximately 500 lb. weight is obtained.

FORWARDING COTTON.

Every grower has a registered number, and should include this with his initials and railway station in a brand for identifying each container he sends. The brand should be placed in a conspicuous place on the side of the container in black that will not rub or wash off. Each season a number of wool packs are received at the ginnery which have no identification marks, or on which the brands are so indistinct that they are not legible, and it is only through checking up the advice notes which a grower despatches to the Cotton Board when forwarding his cotton that the ownership can be established. This slows up the work at the ginnery, and should not occur.

GRADING.

When the container of seed cotton arrives at the ginnery the contents are examined by a grader, who first determines the grade. "Grade" means a combination of the colour, body, and strength of the cotton and the amount of trash or foreign matter in it. The grades used are based on the Universal Standards for American cotton, which are recognised in all official cotton exchanges. The grader determines next the length of the fibres, or staples it, as the operation is termed. Each container is then weighed and checked against the amount of cotton the grower states on his advice note to the ginnery, after which it is segregated into the proper stack for ginning according to the grade and staple. When the cotton is being ginned two samples are drawn from each bale of lint in such a way as to represent the true contents. These are sent to the classing room, where another grader staples and grades them against a set of lint standards, which are based on the key set of Universal Standards for American cotton that is obtained from the United States Department of Agriculture, every time new reference sets are prescribed. The true contents of each bale of lint are thus determined before delivery to the spinners. The lint grader is also advised of the grade and staple of each container of seed cotton from which each bale of lint is obtained. This enables him to check on the classifications of the seed cotton grader throughout the season and thus ascertain if the seed cotton is producing lint of the quality that has been estimated before it is ginned.

GINNING.

The product obtained from the open boll is composed of seed and fibres, and is called seed cotton. It is necessary, therefore, to separate the seed from the fibres before the latter can be spun into yarns of various kinds, and the process used in effecting the separation is called ginning. The basic principle of all ginning establishments or ginneries, as they are termed, is first to remove as much trash, dust, and other foreign substances as possible by various cleaning machines, and then to separate the fibres from the seed. There are two kinds of ginning machines—roller and saw. The roller gin consists of either one or two long leather covered rollers which revolve at slow speed and pull the fibres between a fixed knife pressing on one roller, and a stripper bar which tends to push the seed out of the fibres as they are drawn through by the rollers. This form of ginning is used mostly for the very fine diametered long staple Sea Island, Egyptian, and similar types of cotton, as owing to the slow ginning the long fibres can be removed from the seed without damaging them. The American Upland cottons and similar types are ginned on saw gins which have a much greater output for a given time and therefore greatly reduce the cost of ginning. The saws of this type of gin closely resemble the ordinary circular wood saw, only the teeth are of finer width and mounted at an angle which points them in the direction in which they revolve. The saws are usually 10 or 12 inches in diameter and 70 or 80 of them are mounted approximately five-eighths of an inch apart on the one spindle. A steel half-circular grid slotted to match the spacing of the saws is mounted so that the teeth of the saws just show through on the concave side of it. This grid is part of a cylinder into which the cotton drops after being cleaned, and as the saws revolve and remove the fibres from the seed a rolling

motion is imparted to the seed cotton which forms it into a big core of seed and seed cotton. This is called the breast roll and is of marked assistance in the ginning, for as the locks of seed cotton are fed into the cylinder, the breast roll presses them against the saws, which insures uniform removal of the fibres from the seed. An air-blast blows the fibres from the saw teeth into a condenser, whence they are fed to hydraulic presses for baling. The resultant bales are enclosed with a hessian covering and then bound with heavy wire ties, the average bale weighing 500 lb.

OIL MILL OPERATIONS.

The cotton seed separated from the fibres are important to the cotton industry, in that they are the source of several valuable by-products which are obtained in the oil mill. When the seed arrives at the oil mill it is covered with dense short fibres called "linters." These have nearly as many varied uses as have the long fibres or lint removed in the ginning operations. Among the more important, are their use in making motor-car upholstery, felts, medicated cotton, and after being treated chemically, as a source of supply of cellulose for the manufacture of high explosives and artificial silk. Large quantities are used annually throughout the world. All foreign matter is first extracted from the seed, and the linters are then removed by delinting machines which resemble the ordinary gins used to remove the cotton fibres. The delinted seed are next hulled to remove the seed coats, after which the kernels are rolled or "flaked" and cooked to release the oils. The cooked meal is then spread in a thick layer between cloths made of camel hair and pressed in hydraulic presses to extract the oil. The residue is in the form of a hard slab called "cake." After the cloths are taken off, this is ground into fine golden coloured meal, which is a valuable concentrated stock food of high protein content that is used in large quantities in dairying countries where "hand feeding" is practised. Unfortunately, the value of cotton seed meal has not been sufficiently realised by Australian dairymen, and a large proportion of the meal has been exported as "cake" during good seasons in past years. In the 1936-37 drought, however, the supply of meal could not meet the demand, and it is to be hoped that in the future a greater regular use of this meal will be made by dairymen. Cotton seed meal is also a valuable sheep feed, and for this purpose it is pressed into cubes so that the sheep can be fed in the paddocks without loss of meal. A quarter of a lb. of cubes a day with some roughage keeps the sheep in good condition, and such feeding has been the means of saving thousands of sheep during very dry years. Cotton seed meal is also a valuable food for pigs, calves, and horses when fed in proper amounts. Information should be obtained from the Department of Agriculture and Stock for the correct feeding of these animals.

When the cooked kernels are pressed, a fatty oil is obtained which, after it is refined, is used in the manufacture of margarine, toilet soaps, and for cooking oils. Practically all of the Australian requirements for cotton seed oil are supplied by the Queensland Cotton Board.

From even this brief outline of the oil mill operations it can be realised how valuable are the cotton seed and their by-products, and what an important part they have in the economic life of a community. It is mentioned in this respect that approximately 7,000,000 tons of cotton

seed are crushed annually throughout the world. It is especially important to a pastoral country like Australia that large supplies of cotton seed meal be produced locally, and it is to be hoped that a greatly increased use of such a suitable concentrated stock food will be practised when its value is more fully realised.

MARKETING.

The whole of the Queensland cotton crop is handled each season through a compulsory Cotton Pool, which is managed by a Cotton Board composed of one elected cotton grower from each of the six districts into which the cotton areas are divided, and a representative of the Director of Marketing of the State Department of Agriculture and Stock. As soon as a grower places his cotton on rail the Pool takes possession and pays all transportation, ginning, and marketing costs. The growers, through a Co-operative Association, own their ginneries for ginning the crop and the oil mill for treating the resultant seed, thus ensuring to them the full value of their crop.

When a consignment of cotton arrives at the ginnery it is graded and the poundage of each grade and staple length is obtained, for which a first advance is paid to the grower, which usually is an estimate of 80 per cent. of what the average basic value of the crop will be, plus a premium for the grade and staple if his cotton is above the basic value, and any bounty paid by the Commonwealth Government. As sufficient moneys accumulate from the sale of the crop, further advances on a flat rate per pound of cotton are paid to each grower until the sale of the crop is completed.

The sale of the crop in Australia is made direct to the spinners by the Cotton Board, so that no commissions are paid other than those to overseas brokers selling any portion of the crop not required in Australia. Under this system the grower is assured of his crop being ginned and marketed to the best advantage for him. Charges are eliminated wherever possible, and the costs of operation more than bear comparison with those of other countries working with labour charges similar to those of this country.

YIELDS.

Cotton, in common with all other crops that can be grown in the cotton-growing districts, is subject to fluctuations in yields caused by various factors. Adverse climatic conditions, unsuitable soils, incorrect cultural methods, wrong varieties and insect attacks, all affect the yield obtained from a crop of cotton. Generally speaking, however, where the right combination of variety, soil, cultural methods and climatic conditions exist, good to excellent yields are obtained over much of the south-eastern portion of the State. As the growers become more experienced and further progress is made in solving the problems connected with soil investigations, developing improved stocks of the best varieties and combating insects, which in some seasons cause serious damage in some districts, the general average yield will undoubtedly be raised. As it is, the average of the better growers over a series of years is 700 lb. of seed cotton per acre or higher, according to climatic and soil conditions. In good seasons yields of 1,200 to 1,500 and occasionally 2,000 lb. seed cotton per acre are obtained by the best of the growers in many of the districts. The

problem confronting all concerned in the industry is to ascertain and adopt methods which will produce yields each season in keeping with those now obtained by the better growers. Undoubtedly much progress can be made in this respect if all growers pay greater attention to the points which have been touched upon, for the suggestions offered are based on the methods used in producing the higher yields, and on the results which have been obtained from investigations carried out at the Cotton Research Station and in the different cotton districts.

It has to be realised, however, that failures occur in every agricultural crop that is dependent on rainfall. Although the cotton crop may fail when exceptionally adverse conditions are experienced, the general results that have been obtained indicate that cotton is about the most reliable crop that can be grown in many of the districts which are suited to its production.

COTTON VARIETIES.

The varieties of cotton grown in Queensland are all of the Gossypium hirsutum type, the botanical family which includes the American Upland cottons. During the American Civil War the long stapled Sea Island cotton was grown along the Brisbane, Albert, and Logan Rivers with some success, and following the World War, Egyptian varieties were tried, but without satisfactory results. The Sea Island classes are luxury cottons to-day, and it is only in countries with highly suitable climatic and economic conditions that they can be grown, and even there restriction of acreage is practised in order to obtain profitable prices. The Egyptian cottons likewise require special economic conditions, and do best under irrigation in arid climates.

It is believed, therefore, that the American Upland cottons are by far the most suitable for Queensland. The climatic and soil conditions in most of the cotton districts here are similar to those ruling in many parts of the cotton-growing areas of the United States, where the bulk of the American Upland types are grown. Likewise, these cottons with their larger bolls and coarser fibre can be picked and ginned much cheaper than the small boll, fine diametered fibre types, which is an important point, for the cost of production is one of the main problems connected with growing cotton in this country.

The most suitable variety of cotton to grow depends so much on soil type and climatic conditions that it is suggested the reader had best enquire of the nearest Cotton Officer, Department of Agriculture and Stock, for the particulars concerning his individual conditions unless he is in a one-variety district. A full description of the soil type, original timber, and cropping history should be forwarded, for rather pronounced differences in suitability of varieties exist in many districts.

PURE SEED SUPPLIES.

The responsibility of developing supplies of seed of suitable varieties of cotton for the different districts of the State is vested in the Department of Agriculture and Stock through legislation, passed with the approval of the representatives of the growers at the end of the period of Government guaranteed prices in 1926. A Departmental staff had been organised to develop suitable varieties during the period covered by the guaranteed prices, and it was believed at

the termination of the period that it was desirable the Department should continue to have sole control of the pure seed operations. The aim of the Department has been to organise the districts on the basis of one-variety communities, wherever possible, producing cotton of the highest quality that the conditions would allow. Under this scheme several varieties producing fibre ranging from $1\frac{1}{16}$ to $1\frac{1}{8}$ inches full were developed to supply suitable cotton for export, and then later, as the knitting industry developed in Australia, modifications were made to meet the local requirements. In recent years a demand for cottons ranging from $\frac{7}{8}$ to $1\frac{1}{8}$ inches has arisen, and stocks of seed of several varieties of this type are now available for general distribution. Unfortunately, varieties of this class have shown a marked preference for definite soil types and climatic conditions, and growers should obtain information from the Department concerning them. A large number of varietal tests have been conducted by the Field Staff of the Cotton Section to ascertain the requirements of each variety, and it is possible to supply a grower with a reliable cotton that produces lint of the type demanded by the Australian spinners.

Cotton is an easily cross-pollinated plant, hence it is essential that rigid precautions be taken to reduce all chances of contamination between varieties. It is necessary, therefore, to isolate fields producing seed for planting purposes by at least a half a mile from other cotton and on soil where cotton was not grown in the previous season. Likewise, the greatest care has to be taken at the ginnery to prevent an admixture of seed in any of the operations connected with stacking the containers of seed cotton, ginning, heating the seed to kill insect life, and delinting the planting seed. It is obviously advisable, therefore, to have only the minimum number of varieties necessary to meet all requirements, and wherever possible, to develop a district on the one-variety basis. This is being attempted in all cotton-growing countries, for it has been demonstrated that it is not only advantageous in maintaining the purity of a variety, but also in developing cultural practices, and in marketing the crop.

Unfortunately, any variety of cotton will deteriorate rather rapidly unless the purity of the type is maintained by carefully conducted breeding operations. It is necessary, therefore, to develop a system of seed replacement in every variety grown, whereby in each season pure stocks can be made available for distribution. The system which has been developed in Queensland aims at sending to the oil mill each season all seed that is in more than the fourth year of multiplication after being released for general distribution. By this method it is hoped to maintain a high standard of quality in each variety.

VARIETAL TESTING.

Before a newly introduced variety or a strain of an old established variety can be released for general distribution it is necessary to test it against the varieties already grown commercially to ascertain its merits. Many growers think this can be done by planting single plots of from 1 to 5 acres of the new variety and comparing the yield with that of their general crop. The experiences of all countries have demonstrated, however, that carefully conducted tests over a series of seasons, and on different types of soil, are necessary before the merits of a variety can be fully determined. A field staff has therefore been developed in the cotton section of the Department of

Agriculture and Stock, to assist growers wherever possible, in conducting varietal and strain tests in the main cotton-growing districts. Plans of properly laid out experiments are also sent to growers in the smaller isolated districts, to enable them to test varieties in a manner which will give them reliable results. Each season a considerable number of such tests are arranged, and the results obtained have been the means of determining the most suitable varieties for a large number of individual growers, and for several of the main districts.

Plate 112.

TESTING FOR STRENGTH AND DROUGHT RESISTANCE IN A BIG BOLL VARIETY.—Each season thousands of plants are examined by the cotton section of the Department of Agriculture and Stock, and upwards of 2,000 plants are picked individually for further inspection in the laboratory. Progeny rows of the plants selected finally as worthy of further study are planted in the following season in breeding blocks, where the uniformity of plant and fibre characters is carefully studied. The most promising progenies are kept for further increase and trial. In this manner suitable strains are being developed of the main varieties now being grown.

RESEARCH AND ADVISORY ACTIVITIES.

A member of the Field Staff is stationed in each of the largest cotton-growing districts, to conduct varietal tests, allot pure seed increase plots, carry out cultural and fertilizer investigations, and advise growers on general cotton matters. Another important duty of the field staff is to test out the findings obtained in the investigations carried out at the Cotton Research Station and to develop modifications of them to suit the range of conditions existing in each district.

The work conducted at the Cotton Station, which is in the Callide Valley, the largest cotton-growing district, includes a wide range of studies embracing varietal testing and breeding of cotton, and other crops used in crop rotations; cultural practices, and their effect on the composition of the soils; soil moisture studies; and entomological problems. Wherever possible, problems arising in the cotton districts

are studied at the station, and marked assistance has been obtained from the work carried out there in explaining the causes of some of the difficulties that have been experienced in many of the cotton areas.

CONCLUSION.

This article has been prepared to convey a general idea of the cotton-growing industry in Queensland, and to present suggestions bearing on the most important features to be studied in the growing of this crop. These suggestions are based on the voluminous amount of data and observations that have been collected from the results obtained at the Cotton Research Station, Biloela, and from the investigations conducted by the Field Staff and the Graders. Further details regarding the major aspects can be obtained from the Cotton Section of the Department of Agriculture and Stock, Brisbane, or from the nearest Cotton Field Officer stationed at Rockhampton, Biloela, Monto, Mundubbera, and Kingaroy.

AN EMERGENCY CROWBAR.

A very efficient crowbar can be made from an old double-ended pick head, a large-size gate hinge, and a stout handle of spotted gum or similar wood. The

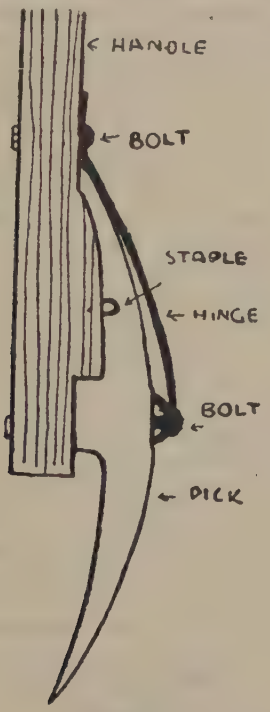


Plate 113.

diagram shows how these are utilised and held together by two stout bolts. This tool will be found most useful when sinking post holes.

Spraying and Jetting of Sheep.

JAMES CAREW, Senior Instructor in Sheep and Wool.

THAT south-western Queensland is capable of producing high-quality merino sheep was made evident by the fact that, during my recent tour of this area, I noticed a big improvement in the young sheep. This may be due to some extent to the good season; but, apart from this, quality and character were showing up very prominently.

At Yamburgan some good-quality young rams were seen. This property has been improved considerably during the last few years and what was, a few years ago, thickly timbered and practically waste lands has developed, as a result of ringbarking, into well-grassed areas capable of maintaining five sheep where previously one could not live. At Noondoo also the flocks now are showing more size and stronger constitutions, and assuredly this will increase the wool yield per head. Needless to say, much forethought and good management is necessary, and this must be backed up with new blood of improved quality and selected to suit the flock.

Difficulties are met with, and these can be surmounted only by grim determination and a knowledge of the most satisfactory methods to adopt. When good seasons come they bring with them a big relief so far as the pastures are concerned; and these were manifest in the large areas of Mitchell grasses which, although dry, resembled waving wheatfields. These good seasons also bring a heap of troubles to the sheep owner in the form of the dreaded blowfly. Where large numbers of sheep are to be protected, this is no mean task and needs to be undertaken in anticipation.

Under the Spray.

Mr. Young, the general manager, was leaving little to chance on the day we arrived at the yards. A large flock of ewes, shorn two months previously, were being put through under the spray which takes the place of a plunge dip to control lice in sheep, and which, owing to its arsenical content, also assists in controlling fly strike.

In the application of this method, the sheep are enclosed within galvanised walls about 8 feet in height, the structure being 50 feet in length and 9 feet 6 inches in width. The bottom is composed of battens which are made in sections to fit from wall to wall, and four feet wide, the battens being placed ½ inch apart to allow for a speedy getaway of the surplus spray. Under this battened floor are 10-feet lengths of corrugated galvanised iron which have a fall to the side where a deep guttering is placed just outside the wall. The 10-feet length allows for the iron to project outside the wall at the low side. There are two galvanised iron gates—one at the entrance and another 25 feet away or in the middle of the enclosure.

The spray fittings are fixed to 1-inch water piping and placed in two rows overhead on cross bars. The mixture is measured into a tank to which a power pump plant is attached, and is pumped into the spray system, which sprays over the sheep for eight minutes. The closer the sheep are packed the better, as the mixture is forced into the skin which it follows, giving a fairly thorough soaking. When completed the iron gate in the middle of the enclosure is opened and the sheep allowed to go forward into the other half of the enclosure. While they are going forward the iron gate leading to the yards is opened, when the sheep to be sprayed will follow readily those which already have been sprayed. The centre gate is then closed and the spray section of the enclosure filled. While these are being sprayed the sprayed sheep are draining and the drip caught by the iron under the floor is drained into the guttering and back through a strainer into a receptacle from which it is used again. Ewes heavy in lamb can be treated by this method without risk, and it is estimated that 8,000 sheep per day can be dealt with.

In another yard sheep with longer wool were held for jetting as a protection against fly strike. In this case the sheep were run through a race in which a cage was placed. This cage is fitted into a frame to allow it to swing or partly revolve, securing the sheep in the cage with its hindquarters fully exposed to allow a thorough jetting.

There is a big difference between spraying and jetting, as the former is sprayed on in a fine shower, while jetting is forced through a nozzle at high pressure—say, from 60 lb. per square inch for short-wooled up to 160 lb. or even over for long-wooled sheep. Care and judgment is necessary, the skin being easily damaged with this high pressure. The recognised strength of an arsenical dipping or spraying mixture is ·2 per cent. arsenic, while for jetting it varies from ·2 to ·8 per cent. in keeping with the regulations.

A PROFITABLE LITTER.

The litter of twelve large white pigs, bred by Mr. M. G. Bayliss, Kinton Stud, Maleny, and check-weighed by the Department of Agriculture and Stock, made a very creditable weight.

Farrowed on 22nd May, 1937, the pigs were from Highfields Pear 29th and sired by Highfields Hardshot 3rd.

The total litter weight at eight weeks old was 446 lb., the average being 37·1 lb.

Type Classification of Pigs.

This article has been abridged from a pamphlet—"British Pigs for Queensland Farms"—issued by authority of the Hon. Frank W. Bulcock, Minister for Agriculture and Stock.

THE farmer desiring to embark in the pig raising industry must give careful consideration to the question of breed characteristics and trade types before coming to a definite decision.

Pigs are usually classed into two trade types, namely, porkers and baconers, and even breeding stock are distinguished as being of the porker or baconer type according to their size and rate of maturity, the smaller and more compact pig being classed as a porker type and the larger and more rangy pig as a baconer type. There, of course, is an intermingling of these two types, and when an extreme bacon type is mated with the extreme pork type the resultant progeny usually are intermediate in type.

With this knowledge we can say that, in general, the Berkshire and Middle White breeds are of the porker type because of their compact structure and their tendency to fatten and provide a "finished" carcase at porker weights, namely, from 60 to 100 lb. dressed. It must be realised, however, that this is merely a general classification of these breeds as a whole and not of every individual animal within the breeds, for a big variation will be found in the types of individuals. Thus, some pigs of the Berkshire and Middle White breeds could be classed as bacon types.

BERKSHIRES IN AUSTRALIA.

England is the home of Berkshire pigs, and from the herds of Great Britain Berkshires are sent to many parts of the world to form new studs and to strengthen studs already established. In Australia the Berkshire is the most prominent among our several breeds of pigs, being found to adapt itself to a wide range of climatic and economic conditions.

The greatest use of the Berkshire pig is made where the breeder wishes to supply a porker market, and breeds Berkshires pure or crossed

with other porker type pigs, or where it is desired to produce a medium type pig such as a heavy porker or light baconer from 100 lb. to 120 lb. dressed weight by crossing typical Berkshires with pigs of the extreme bacon type.

There are some very lengthy Berkshires which, if bred pure and carefully fed, will produce a good light bacon carcase. These pigs are the extreme rather than the average of the breed, but it is important for breeders to realise that such types do occur within the breed.

Breed Characteristics.

The typical British Berkshire is a blocky and symmetrical pig, well covered with flesh, and standing on comparatively short legs, showing reasonably fine bone. The head and face of a good Berkshire should be neither too small nor too large in proportion to the size of the pig, the nose being moderately short and the face slightly dished. The jowl should be light and neat.

Plate 114.

Burnham Prim Boy, sire of the imported boar, Burnham Griqua Baron, whose pedigree is shown herein.

The neck should be of medium length and not too thick, running smoothly into the shoulders, which should be broad enough and deep enough to provide good chest room, but they should not be excessively developed on the sides or top, the shoulders and fore parts of the pig being of low relative value to the butcher and consumer.

The back should be long and slightly arched to give strength. The ribs should spring from the spine, giving a flat back—but not too wide. The sides should then be flat and deep, carrying down straight to give a strong, thick "streak" in the carcase. The loin should be well developed and the hams should be broad, deep, and well-filled in between.

The legs should be relatively short, with fairly fine bone; and they should be placed well apart "at the corners of the body." Legs which are bent or which are placed in underneath the body are undesirable. The feet should be compact and strong.

Both boars and sows used for breeding purposes should have a good number of well-placed and well-developed teats. Twelve or more are usually considered a satisfactory number. As a boar will affect the teat number of his progeny, it is important that he, too, should be well teated.

In general appearance Berkshires should show character, masculinity in the boar and femininity in the sow, quality combined with size and vigour. They should be well-balanced and free from deformities of any kind.

Plate 115.
Dringhouses Resolute, sire of the imported sow, Chapel Rosary, whose pedigree is shown herein.

Early Berkshire breeders fixed as their standard colour of the breed black with white points, i.e., white on the four feet, the face, and the brush of the tail, and this is the standard colour as set down by the breed societies for the present-day Berkshires.

It is well known to those who have had the handling of Berkshire pigs that the standard of colour and markings as set down for the breed is rarely attained, and it is a very difficult matter for breeders to get the exact marking which they require in the breed. Even when well-marked pigs are bred from, the progeny usually show some variation from the ideal marking seen in the parent stock; but it must be understood that there is more chance of getting well-marked pigs by mating boars and sows which are well marked than by mating those which are badly marked. While the breeder of Berkshires wishes to pay attention

to the breeding of well-marked animals, he must not neglect other characteristics such as conformation, quality, and productiveness, which, after all, are the most important features of any breed of pig. It should be borne in mind that pigs are used primarily to produce pork, and it is often necessary for both the stud breeder and the show judge to overlook slight faults in the markings of the animals. So far as it concerns the farmer who is using Berkshire pigs for the production of pork and bacon, the colour markings count little, and the more important characteristics are productiveness, type and quality.

THE MIDDLE WHITE PIG.

The Middle White, also sometimes referred to as the Middle Yorkshire, was founded in Yorkshire, England, by the judicious selection and mating of native and introduced stock, the objective being to evolve a medium type of pig for the production of quick-maturing porkers.

Plate 116.

Fulford Wink, dam of the Middle White boar, Lancefield Gentleman, who was mated to the imported sow, Wratting Patty 3rd, prior to her leaving England.

The Middle White is more compact than the Large White—in fact it closely resembles the Berkshire in general type, but typical pigs of the breed usually have a shorter and more turned-up nose than average Berkshires.

The Middle White pig is used particularly in the production of light-weight porkers or for crossing with larger-type pigs for the production of heavy porkers or light baconers.

The breed has a well-earned reputation in the porker class at Australian shows, and Queensland breeders are familiar with its successes in these classes at Brisbane shows. Middle Whites made a very successful

display in the porker carcase competition conducted at the Brisbane Abattoir some years ago, when pigs of this breed won first and second prizes.

The fine bone and fine white skin of the Middle White porker make it a very attractive carcase which the butcher is always pleased to handle. In addition to its carcase qualities the Middle White is a good farmer's pig, being extremely docile, and the sows are usually excellent mothers and very prolific.

When Middle Whites are mated with Tamworth or Berkshire pigs the white colour is dominant, and the resultant progeny are mostly white.

Plate 117.

Watford Gracious Lady, dam of the imported sow, Watford Gracious Lady 37th, whose pedigree appears in this booklet.

Breed Characteristics.

The colour of Middle Whites should be:—Pinkish skin, free from black or blue spots, and a coat of white hair free from black hairs. The nose should be somewhat shorter than that of the Berkshire, but the head and jowl should be light in proportion to the body. The shoulders and neck should be neat and light, the back slightly arched and long. The ribs should spring out to give a flat back, but should then descend to give a straight, deep side and full underline.

The hams of the Middle White should be large in all directions. The legs should be comparatively short, strong, and straight, being set on the outside of the body, not close together or sloping in under the pig. The feet should be compact and strong. At least twelve well-developed and well-placed teats are desirable in breeding stock.

The Middle White should be compact but not dumpy, and show plenty of character and vigour in its action and general appearance.

Hardiness of Middle Whites.

Whilst criticism is sometimes levelled at white-skinned pigs on account of their so-called "softness," we see them bred successfully from the south coast to the far north of Queensland, and even in the inland districts, with excellent results, and experience has shown that white pigs can hold their place with the dark-coloured provided they are given reasonable attention and kept free of lice and mange by oiling should the necessity arise.

Details of the pedigrees of the imported pigs of the Berkshire and Middle White breeds, which were selected by the best available judges in England, and are said to represent the best of the British herds, can be obtained from the Department of Agriculture and Stock, Brisbane.

REARING PIGS WITHOUT THE SOW.

Newly-born pigs are frequently deprived of the sow's care through death or sickness, or because the litter is too large. If taken in hand as soon as they are deprived of the sow's milk there is a very good chance of the pigs being reared successfully by artificial feeding. If they are left too long without sufficient food, however, they become weakened and difficult to rear.

Sometimes a large litter is divided into two lots, and each lot is put with the sow separately for a drink at frequent regular intervals. Although this entails a lot of attention, it gives satisfactory results. Foster mothers are sometimes available, and a sow with a small litter may be given some pigs from another sow, provided they are about the same age as her own.

When hand feeding is resorted to the pigs should be given a warm, dry camping place, and have access to clean pasture. A movable shed in the run is very convenient. In the absence of the sow's milk, which helps to build up a natural resistance to disease, every possible precaution should be taken to prevent infection in the young pigs. A clean and comfortable pen should be a first consideration. Access to pasture assures a supply of vitamins and minerals, which are essential to a complete diet.

A method of feeding which has given very good results with pigs taken from the sow when a day or two old is as follows:—Start the pigs on whole cow's milk fed warm and as fresh as possible, six times daily. After three weeks the whole milk may be gradually replaced by separated milk, and the six feeds daily may be reduced gradually to three feeds daily. When the change from whole to separated milk is being made, a trough of a dry meal containing 90 per cent. of pollard, bran, maizemeal or wheatmeal, and about 10 per cent. of meat-meal should be kept in the pen with food always available to the pigs. This trough must be sheltered and kept dry. A constant supply of drinking water should also be kept before the pigs when they are given the dry food.

In teaching the young pigs to drink, the bottle and teat are neither necessary nor desirable—a shallow dish serves the purpose well. The warm milk should be placed in the dish about ½ inch deep, and the pigs taken one at a time and stood in the dish. Then if the pig is held firmly over the top of the neck its head can be placed down into the milk and held there long enough for it to get a taste of milk, but not long enough to allow it to inhale the milk. This operation may be repeated a few times at each feeding. After two or three such lessons the piglets will usually drink readily without assistance and afterwards will give little trouble.

When the piglets are drinking well the dish may be replaced by a shallow trough. Both the dish and the trough used for holding the milk should be made of metal or earthenware and free of cracks so that they can be cleansed and scalded after each meal. This is most important for the prevention of digestive disorders.

—L. A. Downey, Instructor in Pig Raising.

The Rearing of Chickens.

J. J. McLACHLAN, F.B.S.A., Poultry Inspector.

THAT the rearing of chickens is one of the most vital subjects in poultry-farming is a statement the truth of which will be conceded generally. To be successful in that industry, a flock of well-grown birds, suitable as future breeders, must be raised annually. Although the parent stock may be quite typical, their offspring will be an unknown quantity until maturity is reached and, during their development, they can be made or marred by good or bad management.

In preparing for the arrival of the chickens, first consideration must be given to the housing of them. The use of a laying house is preferable to the building of a special brooder house. The latter would be used only for about four months each year, and to that extent the farm would be over-capitalised. On the other hand, a laying house need only be empty for about four months every two years.

When an old laying house has to be used, care should be taken to put it into a perfectly sanitary condition. If the floor of the laying house is of concrete, burning with a blowlamp will give good results. At the same time it would be as well to make sure that the woodwork is free from external poultry parasites, such as mites or ticks. The woodwork should be painted with creosote. Should the building have an earth floor, the best method of putting it in a good, sanitary condition is to remove a few inches of the earth, replacing it with fresh earth, making sure that the level of the floor is at least four inches above the level of the surrounding land. Care should be taken to see that the drains around the building are deep enough to carry off all flood waters, because chickens cannot live and thrive on damp or wet floors.

If an old building with a netted run attached is used, it will be a decided advantage to turn over the soil and plant some crop. This should be done as soon as the pen is empty of fowls, and if Japanese millet were planted, the chickens would have ample greenstuff, and at the same time be able to eat the grain, by which rearing costs would be lightened.

If second-hand brooders are used, they should be put into a sanitary condition, and for this purpose a blowlamp should be used, as heat will be more effective than disinfectants.

Two Systems of Brooding.

There are two systems of brooding—the heated and the fireless. Brooders that supply the chickens with artificial heat will give better results on the average. Different types of battery brooders, usually heated, also are coming into prominence. With these machines, the chickens have a very restricted run on a wire-netting floor for about four weeks, after which they are placed on the ground in a house. The feeding and drinking utensils should be cleaned, and, if possible, disinfected in the same manner as the brooders.

Having everything in readiness, and in a good sanitary condition, the question of the number of chickens to be reared in each unit has to be considered. It is advisable to keep chickens in small units—preferably in lots of 100, with a maximum number of 200 under one brooder. If

using a laying house that is to accommodate 100 layers, a temporary division of netting should be run down the centre, and 125 chickens put in each section. From this it may be anticipated that the necessary number of pullets would be raised.

Just before the arrival of the chickens, the floor should be covered to a shallow depth with litter such as chaff, sawdust, shavings, or any similar material. Under the brooder an opened-out sack on which sand has been sprinkled may be placed, this material being preferable to litter in heated brooders on account of fire risks. The brooder should be warmed up for a couple of hours prior to the chickens being placed in them.

When the chickens are under the brooder, they should be restricted to a distance of about 6 inches around it. This is best done by circling the brooder with wire-netting. They should now be supplied with clean, cool water. The vessel should be of a kind that permits ample drinking space for the chickens and, at the same time, does not allow them to get wet. Coarse sand and shell-grit should be provided in small trays. Another essential is wood charcoal, and this should be provided in a granulated form in trays. The water, grit, and charcoal should be available to the birds at all times throughout their life.

Feeding Methods.

So far as feeding is concerned, the usual practice is to place the chickens under the brooders direct from the incubators, and to withhold food from them until the next day. The kind of food and method of feeding have an obvious influence on rapid growth.

In my opinion, the all-mash system of feeding dry in troughs will give the best results. An all-mash that has proved suitable is as follows:—Maizemeal, 40 lb.; bran, 20 lb.; pollard, 20 lb.; dried buttermilk, 10½ lb.; meat and bone meal, 7½ lb.; fine salt, 1 lb.; cod liver oil, 1 lb. This ration gave excellent results in experiments conducted by the Department of Agriculture and Stock, and since then the majority of commercial poultry farmers have adopted this method, or are feeding ready-mixed all-mashes based on the experiments mentioned. By placing the mash in shallow troughs, with a piece of netting fitting loosely inside the trough on top of the food, wastage is prevented. It is a good practice to put out only a small amount of mash, and, on each visit to the chickens, to add a little more. This will encourage the chickens to consume more mash, and thus make rapid growth.

To lighten work in this direction, it will be found more convenient to have a kerosene tin of mash in each pen; then the "little and often" practice of feeding will not be neglected. A big factor towards the success of dry-mash feeding is the provision of ample feeding space.

During the first week troughs about two feet long by six inches wide and 1½ inches deep will be ample for 100 chickens. Afterwards the troughs should be about three inches deep and from four to eight feet in length from the second to the sixth week. The length of the hoppers has not been increased in accordance with the rapidity of the growth of the chickens, because it is expected that farmers will commence removing the cockerels as soon as the sexes can be determined.

The ration mentioned is for those persons who are compelled to purchase all foodstuffs. In the event of farmers having suitable food stuffs available, these should be used to advantage. For instance, if

milk is available, the dried buttermilk could be eliminated from the ration. In feeding milk, it is best given in the form of dry curds—that is, with the whey strained. Liquid milk adheres to the feathers, and when the chickens are under a heated brooder it gives off a sour odour, and the fact that special care must be given to cleaning the vessels containing milk is my reason for preferring to feed curds.

As soon as the chickens have become accustomed to feeding, green feed can be supplied. The greens should be young and succulent, as foods of a fibrous nature are quite unsuitable for young chickens.

In the daily routine work, for the first week the brooder lamp should be kept burning; this should apply also on wet or cold days. In working with lamp brooders, it is a wise policy to place a windbreak, such as a sheet of iron, in front of the brooder each night to prevent ground draughts. After the second night, the droppings must be cleaned up every morning, and the sack cleaned and sprinkled with fresh sand. The water vessels should be cleaned out daily, a piece of sacking or brush being used for this purpose.

Care should be taken to avoid spilling water on the floor where chickens are being reared. This can be done by washing out and filling the drinking vessels outside, and carrying them into the pens. Again, if the floor around the drinking vessel gets wet, a frame having a netted top might be made to cover this wet patch, and the drinking vessel placed on it. Wet places on the floor are spots where disease organisms and worm eggs can be picked up, and this danger should be guarded against.

Daily Routine.

The daily routine work must be carried out carefully, the mash and greenstuff being supplied constantly. The grit tins should be kept well filled and an ample supply of clean, cool, fresh water always available, the vessels being kept cleaned out thoroughly.

The brooder lamp must be filled, and the wick trimmed, care being taken to clean off all the carbon from the wick and burner. The gauze below the wick must be clean always, as this regulates the amount of air admitted into the burner, and should this be choked up with dust, the lamp may commence smoking, and would be liable to catch on fire.

During the first week, the chickens should be confined fairly close to the brooder, to teach them where the warmth is, but after that they may be permitted as much liberty as possible. A good run is decidedly beneficial to them.

After the first week, the brooder lamp can be put out in the morning, and relit at about 4 or 5 o'clock in the afternoon, according to climatic conditions. When the chickens are about three weeks old the weaning process may be commenced by reducing the flame gradually so that, when there are only from four to five, there is no need to light the lamp. This is a simple and satisfactory method of weaning them in heated brooders. It is wise to leave the brooder and lamp in position, as the chickens then will camp under the hover. If the hover is removed, they will be liable to crowd. For that reason the chickens should be trained to use the perch before the brooder is removed.

When the chickens have learnt to perch at about six weeks of age the feed can be changed from the all-mash ration to a growing mash and grain. The following is a growing mash that can be fed in

conjunction with equal parts of wheat and finely-cracked maize as the evening meal:—Maizemeal, 25 lb.; pollard, 40 lb.; bran, 20 lb.; meat-meal, 5 lb.; linseed meal, 2 lb.; dried buttermilk, 4 lb.; bonemeal, 2 lb.; fine salt, 1 lb.; cod liver oil, 1 lb. A liberal supply of young, succulent, chaffed greenstuff should be given as a midday meal. This ration could be continued until the pullets are about sixteen weeks old, when a change should be made to the laying mash.

Losses through Sickness.

More chickens are lost annually as a result of chills than from all other causes put together. Even in the case of chickens dying from specific diseases, it probably is true that 90 per cent. of the deaths originated in chills which first weakened the birds and laid them open to other diseases. No treatment can be recommended except the exercise of care in keeping the chickens warm and encouraging them to eat more food, although the supplying of a little milk to drink might strengthen them.

Another annoying trouble is cannibalism, which may take the form of toe-pecking or tail-picking. These vices may be attributed to shortage of food and inactivity. Affected birds should be removed, and the affected parts painted with Stockholm or coal tar. The birds should then be put in a dark place for about half an hour before being returned to their pens. To prevent further outbreaks, their attention must be directed away from the vice. Ample litter must be placed in the pen. In cases of toe-pecking, shavings or chaff should be used. The toes of the chickens will sink into such materials. For tail-pecking, straw should be placed in a heap in the centre of the pen, and the chickens will be so occupied in spreading it out that they will forget their bad habit.

A CLOTHES TROLLEY.

This trolley, which the housewife will find most convenient for taking clothes to the line on washing day, can be made from a large packing case and two old perambulator wheels. The axle is the only article to be bought. Buy a length of round iron from a blacksmith and get him to put a thread on each end. Shape two long boards for the sides as in the sketch, and when these are joined with two shorter pieces to make a shallow box connect the ends of the shaped pieces with

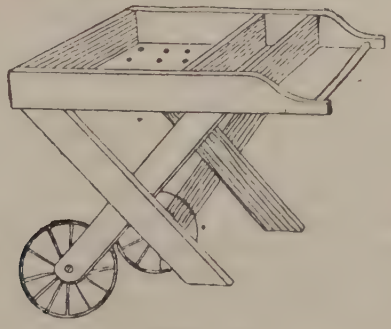


Plate 118.

part of an old broom handle. The large compartment, which has holes drilled in the floor to let the water out, is for the clothes, and the smaller one for pegs. Crossed legs are fitted on either side, and the wheels are attached to the ends of the pair which come from the back, or handle end. A length of galvanised piping, or a long piece of wood with a hole bored through the centre, keeps the wheels in their place on the axle, and a nut on each end secures them on the other side.

History of the Australian Sugar Industry.

IN an interesting paper on "The History of the Australian Cane Sugar Industry," read before the Historical Society of Queensland recently, Mr. F. C. P. Curlewis, general secretary to the Australian Sugar Producers' Association, traced the first record of the growth of sugar-cane to India 600 years prior to the Christian era. In 327 B.C. the first European reference to it was made by Nearchus, an admiral of Alexander the Great, and subsequently its production went through Persia, Arabia, and Egypt, and later to Spain and Portugal. The Chinese also were acquainted with the sugar-cane in the very remote past.

Some sugar-cane plants actually were brought to Australia by ships of the first fleet in 1787, having been shipped at the Cape of Good Hope. Nothing, however, was heard as to the cultivation of sugar-cane in Australia until about 1822, when Thomas A. Scott established a plantation near Port Macquarie, and (in 1824) manufactured a few tons of sugar, as well as some rum.

It is interesting to note that, precisely 100 years later (in 1924), Australia first entered into the overseas export trade in sugar. The cultivation of sugar spread to the northern rivers of New South Wales, plantations and mills being established on the Bellinger, Clarence, and Richmond Rivers in the late sixties of last century.

First Queensland Planting.

The first record of the cultivation of sugar in what is now Queensland was in 1836, when an East Indies planter named Mayo planted a few acres near Brisbane with cane which had come from Mauritius. It, however, was not until the sixties that an attempt to manufacture sugar by Thomas Bowden, in the vicinity of Brisbane, is recorded.

In 1862 John Buhot, who is said to have gained his experience in Mauritius, actually succeeded in making sugar from cane grown in the Brisbane Botanic Gardens. The available appliances were crude in the extreme, and it is said that actually the sugar was made in a domestic saucepan.

In the following year Captain the Hon. Louis Hope had 20 acres under cane at Ormiston, near Cleveland. It was there that the first sugar mill was built, and commenced operations in 1865, the first ton of sugar from the mill being sold by auction in January, 1866. During the visit of members of the International Society of Sugar Cane Technologists in September, 1935, Captain Hope's title as the father of the sugar industry in Queensland was recognised by the formal dedication of a monument to him on the site of the old mill.

Sugar-cane was introduced in the early days from Java and Mauritius, and some years later several varieties were brought from New Guinea by Mr. H. Tryon, an officer of the Queensland Government. One of these varieties (Badila) has played an important part in many of our canefields since.

As the outcome of encouragement given by the Government, nearly 2,000 acres had been taken up in 1865 under what were known as the Sugar and Coffee Regulations, but it was not until 1867 that the manufacture of sugar was regarded as a commercial enterprise.

Sugar Cultivation Spreads.

By 1870 no fewer than twenty-eight sugar mills were operating in Queensland, mostly in the Albert and Logan districts, and developments gradually spread northward to the Mary and Burnett Rivers, later reaching Bundaberg, Mackay, and Ingham, and subsequently the Johnstone River, Cairns, and Mossman in the late seventies and early eighties.

As many as eighty-three mills had been established by 1880, most of them in Mackay and adjacent districts, the total output of sugar for that year being 15,564 tons. The greatest number of mills operating at one time was 166 in 1888, with an output of 59,000 tons of sugar. Of these, only twenty-two were established in the northern districts—that is, from the Burdekin district to Mossman—because, as the industry developed in the northern areas, the policy of larger mills with separately-owned cane farms, rather than attached plantations as the source of supply, was being recognised as a surer method of opening up and populating North Queensland.

Co-operative Control.

During the early eighties a strong agitation against the employment of kanaka labour in the canefields was carried on, and in 1885 Parliament was petitioned for Government assistance in the establishment of central mills, one of the arguments used being that only through the agency of farmer-owned manufacturing plants would it be possible to make canegrowing a white man's industry. As a result, sugar mills were erected at North Eton and Racecourse, in the Mackay district, for which £50,000 was advanced, and provision made for its gradual repayment. Under the terms of the Sugar Works Guarantee Act passed in 1893, central mills were built in eleven centres scattered along the coast from Nerang to Mossman.

After many vicissitudes the whole of these, with the exception of Nerang, are working still. Half a million sterling was advanced by the Government at that time as loans to the farmers in the respective districts. The farmers lodged their deeds as security for the repayment of principal and interest, and the loans were to be repaid over a period of fifteen years. In the event of default, the State Treasurer was entitled to enter into possession of the sugar works as well as of all the lands mortgaged, and to fix the price of cane.

The Mackay District.

The farmers' co-operative mills system received a greater impetus in the Mackay district than elsewhere and prior to federation Mossman (1897), Mulgrave (1896), and Proserpine (1898) were the only central mills established north of Mackay. The main reason for this, of course, was that conditions of living, in those early years, were less attractive to permanent settlers than those obtaining in Mackay and Bundaberg. Later on, when new sugar districts were required, they were all opened up north of Mackay, and co-operative central mills were established at Babinda, south of Cairns, and at South Johnstone and Tully, south of Innisfail.

When Federation became an accomplished fact, a "White Australia" was accepted as a definite policy, and adequate protection was promised to the sugar industry. A duty was imposed by the Commonwealth Government on imported sugar, and an excise duty on sugar

manufacured in Australia; and from this excise a rebate was paid on all cane produced by white labour. By 1907 most of the kanakas had disappeared and, from then on, the industry, under white labour conditions, was faced with regulations and awards in respect to wages and the general conditions of the employment and accommodation of the workers. The first award by an Industrial Court was made in 1914. Incidentally, there were strikes of a more or less serious nature; but, viewing the subject as a whole, it may be said that, whilst the wages awarded by the Court appeared to be unduly high, they eventually attracted a class of labour that has contributed, not only to the efficiency of the industry, but also to the satisfactory type of settler and settlement that has spread through the north-eastern littoral of Australia.

Regulation of Cane Prices.

Seeing that the employees had secured protection by means of industrial awards and regulations, it was not long before the growers supplying both proprietary mills and central mills put in a claim for some method of determining, under statutory authority, the value of their cane. For this purpose the Regulation of Sugar Cane Prices Act was passed by the State Parliament in 1915 and, under its provisions, a tribunal was created with final authority to allocate to each mill the lands from which it should draw its supply of cane and to determine the value of the cane delivered to the mill. This tribunal, known as the Central Cane Prices Board, consisted of a Judge of the Supreme Court, one representative of the millowners, and one representative of the canegrowers, and it is the final board of appeal from the decision of Local Boards that primarily determine values in respect to the cane delivered to each mill. The system then inaugurated has been in force since 1915 and, on the whole, it can be said to have been satisfactory.

Effects of the War.

On the outbreak of war in 1914 the Commonwealth Government immediately placed an embargo on the export of sugar from Australia. Simultaneously, the State Governments, through their price-fixing authorities, took steps to keep the price at normal levels. The result was that the sugar industry did not share in the high world prices that fell to the lot of the established exporting industries. Australia was not producing enough sugar at that time for its own requirements, and importations had to be made at values that, as a result of the war, reached £98 per ton and averaged over £40 per ton, whilst the Australian raw sugar was made available at £21 per ton. The only labour procurable in the country at that time was costly and unreliable, and prices of capital and consumption goods were high; consequently, by the end of 1919, the sugar industry was in a really bad way. Due to the necessity for importing sugar, the Commonwealth Government had taken complete control of the industry so far as distribution and the fixation of prices were concerned, and strong representations were then made as to the serious position to which the industry had fallen. The result was that, in 1920, the Commonwealth Government agreed to place an embargo on the importation of sugar and to increase the price of sugar over a period of three years to such a figure as would enable the industry to get on a sound footing again.

This increased price gave a definite fillip to the industry, and the revival that followed was maintained when, at the expiry of the first

agreement, it was renewed as regards conditions, though the price of raw sugar was reduced by about 11 per cent. About this time the Commonwealth Government relinquished direct control of the industry, and all its subsequent economic conditions have been regulated under an agreement between the Government of the Commonwealth and the Government of the State of Queensland, whereby the Commonwealth on the one hand agrees to impose an embargo on the importation of sugar, whilst the State Government agrees to provide sugar at such a price as will enable the consumer to obtain it at a definite price over a term of years. These agreements have been renewed from time to time, and the price to the consumer remained at 4½d. per lb. for many years, but a reduction to 4d. per lb. was secured by an amended agreement in 1932. Recently this agreement was renewed until the crop of the season 1940 is disposed of.

Export Market.

After the renewal of the third series of these agreements, about 1925 or 1926, it was realised that great developments were taking place in many sugar districts—that production had overtaken consumption and that there was likely to be a surplus every year, necessitating the securing of an export market. This special market was created, almost coincidentally, by the policy adopted by Great Britain of granting preferential treatment in import duties to Dominion products. Hence, the industry entered upon export trade at low values, but with the definite knowledge that it would have to be limited, first, by the reduction created in the average value of the Australian crop; and, secondly, by the preferential requirements of Great Britain. This idea has been haunting the leaders of the industry for many years, and steps have been taken to control production, with the result that, under present conditions, any increase is due chiefly to favourable seasonal conditions, though extra efficiency in production, both in field and mill, is responsible for some of the present output of sugar. The increased production, of course, has added to the employing capacity of the industry and, consequently, there has been a natural reluctance on the part of Governments to create any more unemployment by statutorily reducing production.

Under the International Sugar Agreement finalised in May, 1937, as an outcome of a conference of the principal sugar-producing and consuming countries of the world, Australia is limited to an annual export quota of 400,000 tons and, in addition, the British Government have intimated that they will introduce into Parliament a measure providing for the maintenance of the present preferential duties on Empire sugar. These two factors introduced some stability in the industry, and the limits of our production are now definitely known.

Modern Machinery.

With the passage of time methods of cultivation, crushing, and transport have progressed steadily from the primitive to the most up-to-date. When, in 1916, wages began to assume a heavy item in production costs, an impetus was given to the development of labour-saving devices, such as weeding machines, and cane planters, &c., and, with the introduction of tractors, the use of heavier field machinery was made possible. Now, on the larger farms, it is usual to find two- and three-disc ploughs, grubbers, and double row cultivators. The very

latest machine introduced is the Gyrotiller, which, for all practical purposes, takes the place of a plough, roller, and harrow in turning over and pulversing the soil in a single operation in preparing for the planting. Machines for harvesting cane have been the subject of much study for many years, and three types of machine have been constructed during the past ten years and have been put on preliminary trials. They have not yet reached practical application, though the latest—the Howard Harvester—is a possibility.

Transport is a very important factor in the complete picture of cane harvesting. Cane is a bulky commodity, and transport to the mill, or even to railway lines, by wagons and drays, was found to be definitely uneconomic. Consequently, there has developed a regular transport system under which the millowners purchased their own locomotives and laid down permanent railways, reaching out to the main sources of supply, using their own locomotives and rolling-stock. The cane is hauled from the fields to the main line on a portable line which, in some cases, is provided by the mill and, in others, by the individual grower himself. The transport of the sugar, in most cases, is carried out by Government railway to the shipping ports and thence by large or small steamers to its destination, as the case may be.

The irrigation of the canefields has become almost universal, on account of low rainfall, in the Lower Burdekin district, south of Townsville, and in the last few years much also has been done in the Bundaberg district, though mostly on the large plantations.

In sugar mill machinery, the industry has kept well abreast of the times, and, apart from the general desire for efficiency, contributing factors have been the high wages and the conditions of employment as well as the necessity, particularly in later years, for reducing working costs to meet the low average price received for sugar due to the large proportion of the output that has to be exported.

The organisation of technological research was probably initiated, and certainly very successfully developed, by the Colonial Sugar Refining Company Limited. Its milling work was closely followed by the technical men at other mills and, in field work research, the company's officers were, in the earlier years of this century, practically the only ones who were in a position to make intensive study on account of the fact that they had as a basis of observations and comparisons properties throughout all the principal cane-growing areas of Queensland, New South Wales, and Fiji. Whilst the Queensland Government assisted the industry by despatching departmental officers to New Guinea in search of new varieties of cane and by a general supervision as regards entomology and pathology, it was not until 1898 that a laboratory was erected at the Mackay State Nursery for the purpose of testing the qualities of cane under cultivation, with the idea also, at a later period, of analysing soils, manures, and mill products.

Sugar Experiment Stations.

This was the genesis of the present Bureau of Sugar Experiment Stations which was established by an Act of Parliament passed in 1900. The funds for the administration of this Act are raised by a levy on the industry of, at the present time, 1d. per ton of cane crushed at each mill, the miller and grower each paying an equal part of such levy. The Government originally subsidised this fund by a contribution equal

to the amount levied on the industry but, in recent years, its contribution is limited to £7,000 per annum. The Bureau is therefore now supported by the industry to the extent of substantially more than half of its total revenue.

For many years after its establishment the work accomplished by the bureau did not appear to be giving much result or even satisfaction to the industry, chiefly because, as the then Director (the late H. T. Easterby) pointed out, great difficulty was experienced in securing sufficient trained men to concentrate on the various branches of research required in this connection. It then was realised by the Director that the sugar industry would have to train its own men and, eventually, three three-year travelling scholarships were provided, open to University graduates. In due course these graduates returned to Queensland and are now doing most valuable work both in further research and in assisting the industry in its practical and technical problems.

Notwithstanding machinery and other aids to efficient and economic production, the worker and his labour is still the most important consideration, and, in fact, it is economically a subject in itself. The sugar industry is interested particularly because it is a large employer of labour, both permanent and seasonal. However, from a national point of view, it is satisfactory to note that, as the industry has developed, the nomad workers have decreased, and many of the seasonal workers and their families are making their homes in the sugar districts.

The refining of the raw sugar is the final process before the product is placed on the market for consumers. There are two refineries in Queensland—one at Bundaberg and the other at Brisbane—the latter is owned by the Colonial Sugar Refining Company, which also has refineries in Sydney, Melbourne, Adelaide, and Fremantle.

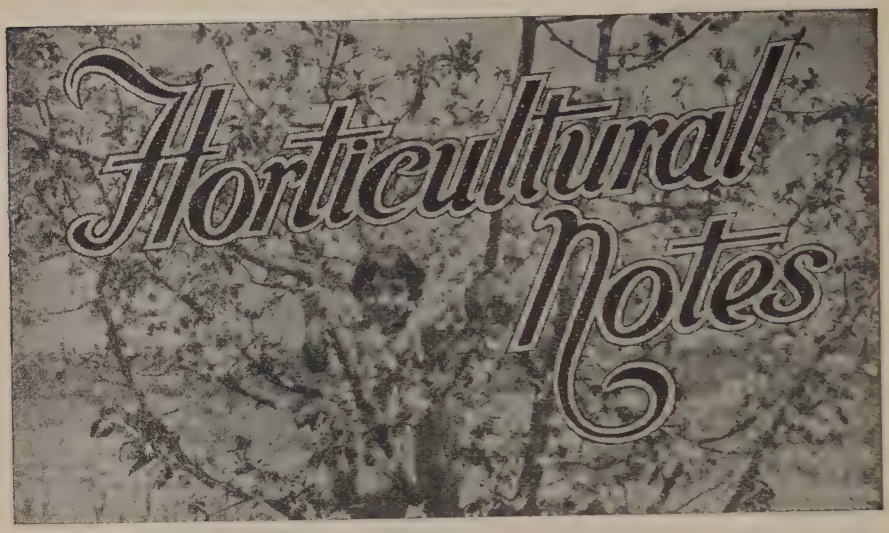
Population Figures.

Evidence of what the sugar industry has done towards the settlement of North Queensland is afforded by official figures. In 1901 the total population of Douglas Shire, Cairns town, Cairns Shire, Johnstone Shire, Cardwell Shire, and Hinchinbrook Shire, was 14,665. In 1911, it had only increased to 17,191. In 1921, in the same area, the population was 25,954, and at the 1933 census in the same area the population was 52,659. This was an increase of over 100 per cent. in twelve years. The sugar districts south of Townsville have also increased, though not to the same extent. In the same period—that is, between 1921 and 1933—the population of Queensland increased by 25 per cent., and that of the whole Commonwealth by 21·94 per cent., so it is clear that the sugar industry is making no small contribution to the factors of development and employment.

THE SOIL.

The soil not only gives us the harvest in due season, but it is the breeder of human character. It is natural to live in the open, to feel the warmth of the sun on the face and the sharp sting of the wind-blown rain.

If for nothing else than the part agriculture plays in the spiritual life of our race, it should be lifted up from discouragements which now beset it like a plague. —"The Farmer and Stock-Breeder" (England).



Marketing Strawberries.

JAS. H. GREGORY, Instructor in Fruit Packing.

QUEENSLAND has become known throughout Australia for its ability to supply high quality strawberries to the Southern States during their out-of-season period. Our single layer carton in which all fruit is open to inspection is now quite a common sight in Melbourne and Sydney.

The regularity of aeroplane transport has opened up new avenues of distribution, many western towns now being able to receive regular consignments of berries. As the strawberry possibly is the most tender fruit we have to handle, special methods of packing are necessary to enable it to be transported long distances successfully. Close attention, therefore, must be paid to all equipment used for marketing this delicious fruit.

CONTAINERS.

Many types of containers are used for marketing strawberries. In some of the Southern States a punnet is in general use, but as this has the disadvantage of containing more than one layer of berries with each layer resting upon the other, it is not as suitable as the single layer packed box in general use in Queensland. There are two types of boxes in use—one which measures 8 inches long by 4 inches wide by 1¼ inches deep—obtainable in either plywood or cardboard—and the other made of wood, 24 inches long by 8 inches wide by 1½ inches deep measured clear of its central partition. The smaller of the two containers is preferable, because it allows less latitude for mistakes and for spoiling the appearance and alignment of the fruit when packing. Being smaller, the fruit is less likely to become loose in the box through careless handling, and so being damaged through rubbing and otherwise. It is also a better container for retailing. The larger box or tray, which contains the equivalent of six smaller boxes, may hold too much fruit for the average buyer when prices are high,

Plate 119.
Using the Picking Tray.

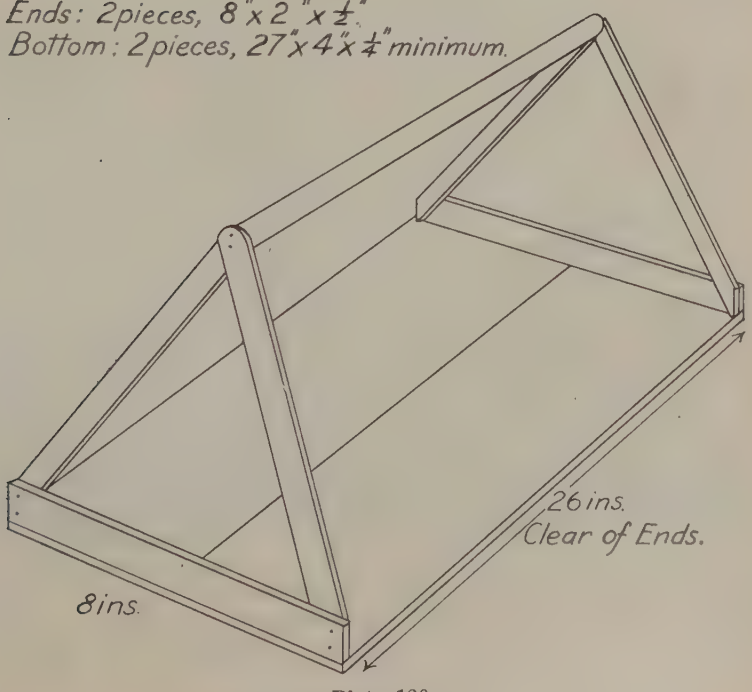


Plate 120.
Picking Tray Holder.

necessitating repacking into smaller boxes. As the strawberry is such a soft fruit, it is desirable that it should be handled as little as possible. The smaller container also has the advantage of allowing for better sizing and packing when the supplies of berries are short. Twenty of the boxes 8 inches by 4 inches by 1¼ inches will just fit comfortably into a half-dump case.

FRUIT PROTECTION.

Fruit should be cooled always before packing and when carried for long distances it must be kept at a cool, even temperature. Fruit should never be placed in the sun, or in places where it will become heated. Exposure to rain, dust, and wind must also be avoided.

PICKING.

Much time and handling can be saved by using a picking container. A good type of picking tray is illustrated (plate 122). An examination of the illustration will show that in addition to having a handle, the tray is fitted with two compartments. Another type is shown whereby an ordinary tray can be used (plate 119). When picking, the first grade berries fit for marketing are placed at one end of the tray, and second class or factory berries at the other. Where growers are picking for Southern markets, this method may be varied. The solid, full, three-quarter coloured berries for distant markets are placed on one end, while the full-coloured ripe berries, fit to send to the local market, are placed on one side of the other end. Jam fruit is placed on the other side of the same end as the local market fruit, being kept separate. The adoption of this system means a great saving in time and handling, as the berries are graded automatically for each market. It should be remembered that in the case of strawberries a saving of even one handling means a lot in increased range of travel and carrying capacity. Berries should not be picked or packed while wet, and all skin-damaged fruit should be rejected rigorously. Fruit that has come in contact with damaged berries also should be relegated to the "jam" quality. Care when picking will minimise the risk of damage to berries. Fruit should be handled as much as possible by the stalk only. It should not be pulled about or turned over in heaps while being handled, because the slightest damage to the skin means an opening for the entrance of rots.

The best method of picking is by using the thumb and fore-finger, the berries being pinched actually from the plant. A stem three-eighths to one half-inch in length should be left on each berry. Berries should not be thrown or dropped into the picking trays or boxes during handling. If the stalk is pulled out from the fruit in any way, the berry should be relegated immediately to the factory grade, as the skin around the stalk would be broken slightly.

HANDLING.

When using the small box or punnet, 8 inches by 4 inches by 1¼ inches, berries are packed for market in three packs—threes, fours, and fives across the box. In the tray 24 inches by 8 inches by 1½ inches the fruit will pack five, six, seven, eight, nine, and ten across. It is only during periods of short supply and high prices that it is recommended to pack tens. Nines and tens are sometimes packed together. Much time and labour is necessary to pack fruit so small,

Plate 121.
A North Coast Strawberry Garden.

and even after packing it still looks a very second-grade article. Sizing is done while packing, the packer having a box for each size. Women and girls usually make the best berry packers, having, as a general rule, a lightness of touch which is often lacking in the case of men operatives. Berries with grains of earth adhering to them, as is the case often after rain, should be gently brushed. This is best done by placing a soft lacquer brush as a fixture, standing upright in the bench, and by taking the berry by the stalk and gently running it through the bristles of the brush. Brushing the fruit in this manner is quicker and more efficient than endeavouring to use the brush in the normal way.

PACKING.

The method of packing is simple enough. The box is first prepared by placing a prepared leaf across the end of the box (plate 123), (passion fruit leaves are very suitable, and, when these are not available, fern leaves sometimes are used); the leaf should project high enough to reach the top of the box, and at the same time be bent enough to place thereon the first line of berries—threes, fours, or fives, according to size. The berries should be placed on their stalk ends with the points up, allowing the point of the fruit to reach to the level of the top of the box. (See plate 124.) Another prepared leaf is then placed in the box, bent so as to rest on the bottom of the box to have the next line of berries placed thereon, while the remainder of the leaf rests against the first line of berries and acts as a separator of the lines of fruit. (See plate 125.) This process is repeated until the box is filled. For travelling, a layer of leaves or fern is placed on top of the finished pack to assist against damage (plate 131).

A study of the different packs in the boxes shows a variation in the count which can be placed in each box. The shape of the berries causes this variation:—

"Threes," 15, 18, and 21 to the box.

"Fours," 28 and 32 to the box.

"Fives," 40, 45, and 50 to the box.

The trays are packed on the same principle as the boxes, the greater width giving the extra number of berries across the end of the case.

For the best results the points to be watched are:—

See that the fruit is placed so that the tips will come as near as possible to the level of the top of the box without touching, and it will then keep snug when the lid is placed in position.

Avoid packing too high.

Keep the alignment of the fruit straight both across the box and from one end to the other. (See illustrations of packed boxes.)

Avoid placing too large pieces of packing leaves between the berries.

See that the berries do not rattle in the box after the lid is placed in position.

Keep all badly-coloured berries out of the box, as they spoil the commercial appearance of the package when displayed for sale.

On no account pack damaged berries, even those only slightly damaged will spoil the keeping qualities of the box. One bad berry will soon make a whole boxful practically unsaleable.

Keep the fruit dry and free from juice.

Grade to an even colour for each box.

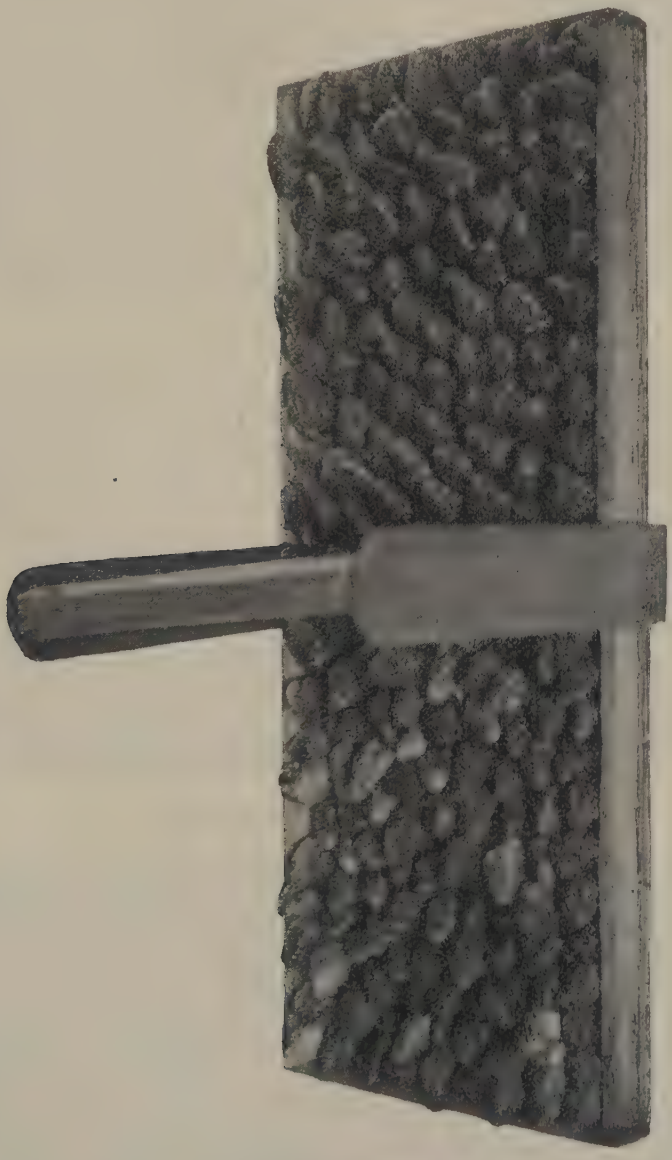


Plate 122.

Picking Tray Filled with Fruit.—Note the difference in colour of the grades of fruit in either end of the tray.

GRADING REGULATION.

The regulations governing the marketing of strawberries are as follow:—

"When strawberries are marketed in punnets, such punnets shall be marked legibly and durably on the top side and also

on the end of the bottom half of the punnet in which the fruit is packed with the name and address of the packer in block letters of not less than three-sixteenths of an inch in height. The following penalties are prescribed for any contravention of this regulation:—

(*a*) For a first offence not exceeding two pounds.

(*b*) For a second or subsequent offence not less than two pounds nor more than twenty pounds."

All the necessary stamping of boxes can be quickly and easily done with rubber stamps. A set of rubber stamps covering all the requisite particulars can be obtained for a few shillings at any stamp makers. It is well worth while also to stamp the grade of fruit on the lid of the punnet.

DESPATCHING.

When packed, the small boxes, if being sent long distances, are packed in Australian dump half-bushel cases 18 inches by 8⅝ inches by 7⅛ inches, the case holding twenty boxes. If not all the one count, the details of the number of each count in the case should be placed on the end. This saves extra handling on the market section. For short transit to local markets the boxes are placed in bundles and tied together in their different sizes. Where a sufficient quantity of boxes is available it always is recommended that the boxes be packed in cases to send to any market. This allows the country order buyer to obtain fruit, knowing there is no necessity to pack it, and so creating a wider demand for consignments.

STENCILLING.

When stencilling, care should be taken to see that stencils are applied neatly, with no smeared edges. Using the stencil ink in conjunction with a handful of engineers' cotton waste to form a pad to absorb excess moisture is economical, and makes neat, clean stencilling easy.

When carting to the rail or market do not use the packed boxes as a seat.

PACKING-HOUSE HYGIENE.

Packing-house hygiene is most important if the risk of disease is to be reduced. Most transit troubles are caused through fungal infections. If fruit is allowed to lie about the packing shed and decay, the risk of infecting good fruit is greatly increased. The difficulty lies in the fact that infection is not noticed at the time of packing, but the development takes place during transit, to the detriment of satisfactory prices. All packing sheds should be thoroughly cleaned up after using, and occasionally sprayed out with a solution of formalin and water—one part formalin to twenty parts of water. All implements should be carefully cleaned and put away until again needed.

As the whole basis of successful marketing is care, growers should follow this principle right to the finish of their share of handling. Good packing, stencilling, &c., will not continue to sell bad fruit, and it is only by care in producing, handling, and marketing good fruit that one is able to meet competition and obtain satisfactory financial results. It must be remembered that the rule, "the consumer is right," prevails as much in the fruit as in other industries.

HOW TO START TO PACK THE BOX.

8 inches long, x 4 inches wide, x $1\frac{1}{4}$ inches deep.

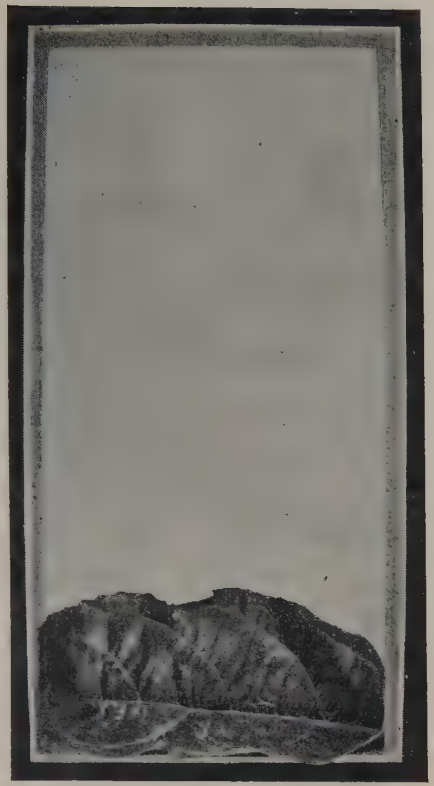


Plate 123.
Leaf in position ready for the placing of the layer of fruit.

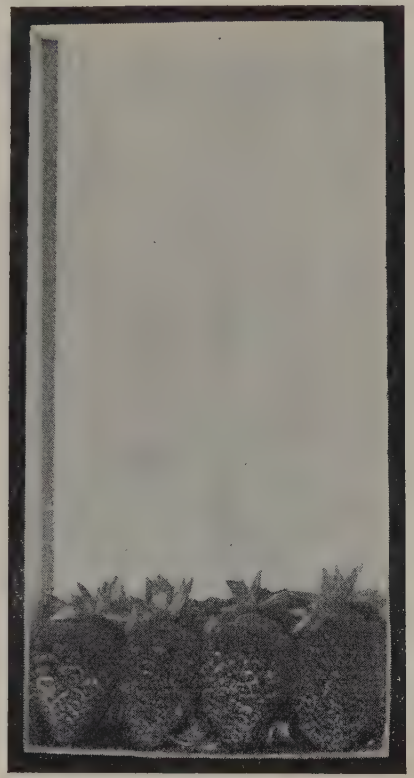


Plate 124.
First line of fruit in position.

Plate 125.
Starting the second line of fruit.

HOW TO PACK "THREES" IN BOXES.

15 Count.

18 Count.

21 Count.

Plate 126.
Finished Boxes.

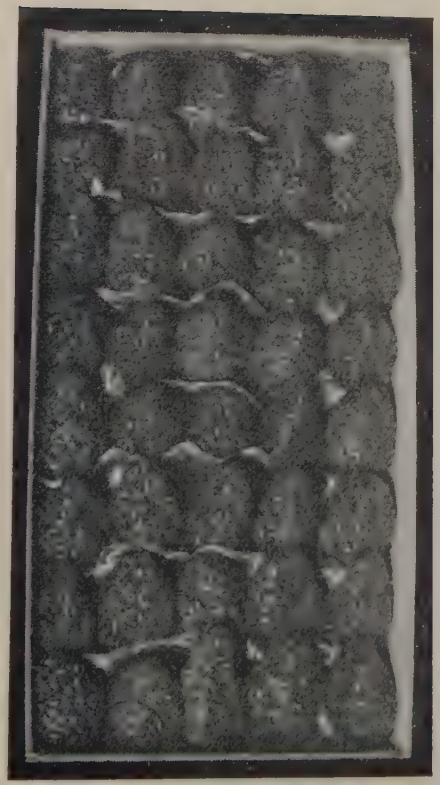
HOW TO PACK "FOURS" IN BOXES.

28 Count.

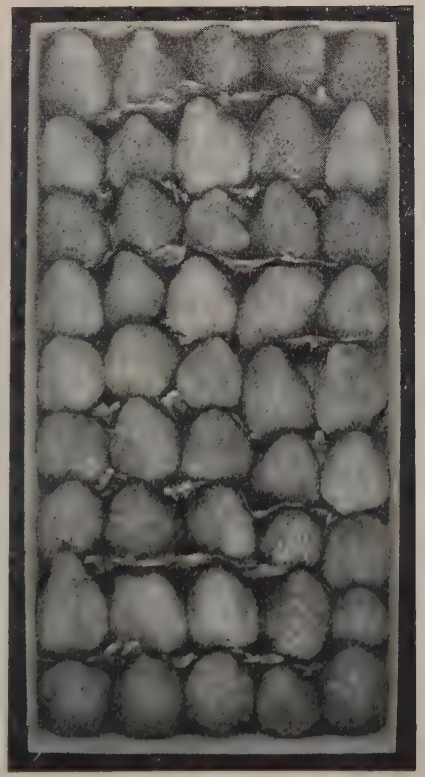
32 Count.

Plate 127.
Finished Boxes.

HOW TO PACK "FIVES" IN BOXES.



40 Count.



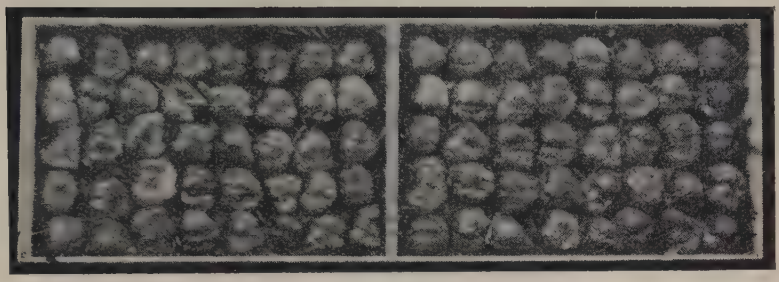
45 Count.

50 Count.

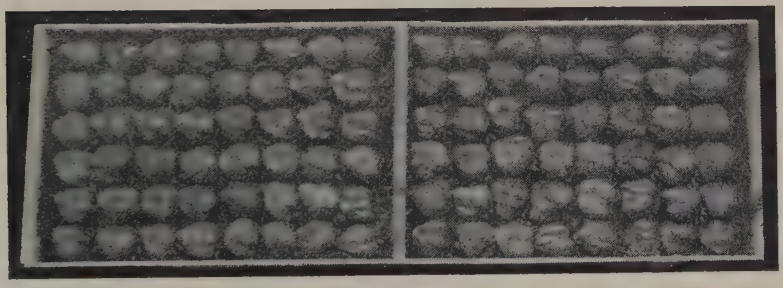
Plate 128.
Finished Boxes.

HOW TO PACK TRAYS.

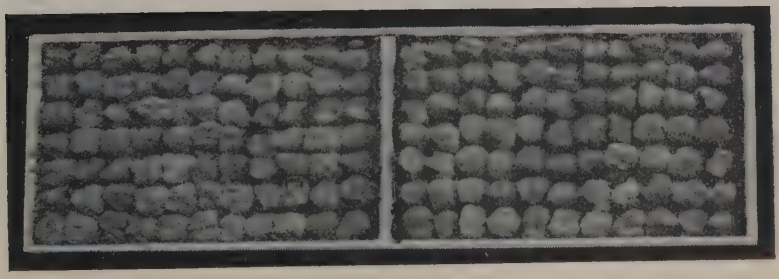
24 inches long, x 8 inches wide, x $1\frac{1}{2}$ inches deep.



Fives.



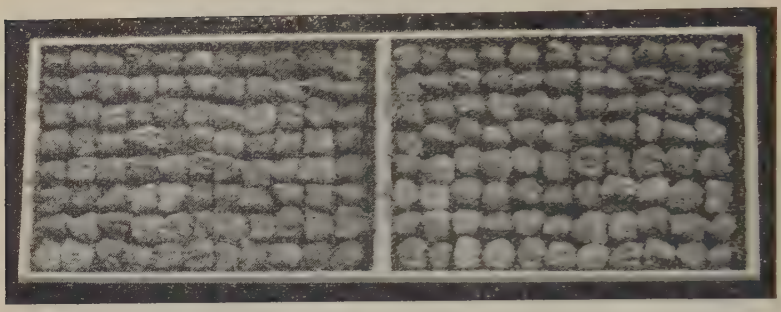
Sixes.



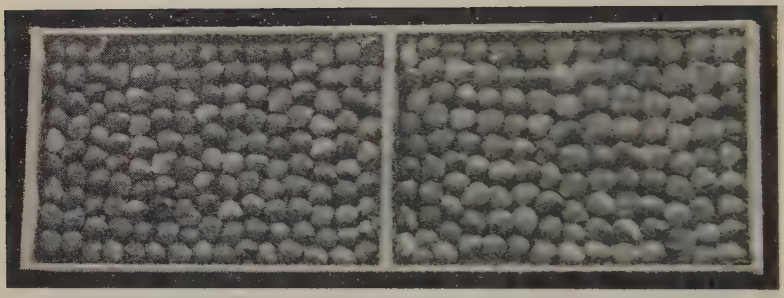
Sevens.

Plate 129.
Trays Packed for Market.

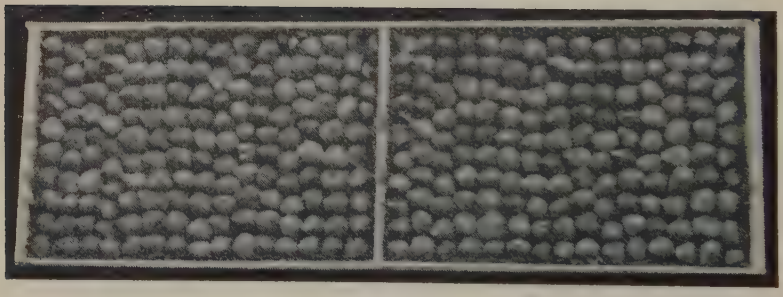
PACKING THE TRAY.



Eights.



Nines.



Tens.

Plate 130.
Trays Packed for Market.

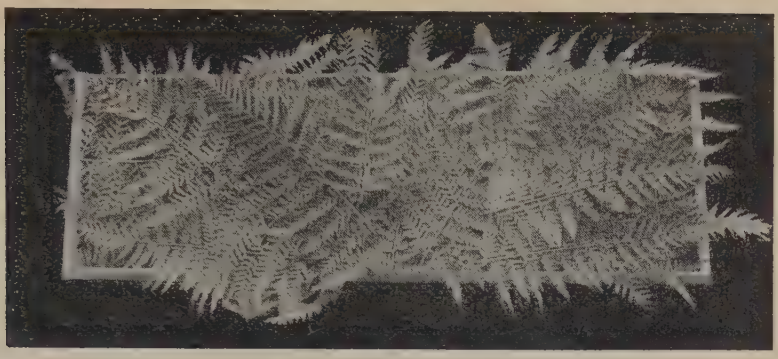


Plate 131.

Finished tray showing the placing of fern on the top of the fruit before placing lid in position. All protruding ends of fern are cut carefully after the lid is placed in position.

FACTORY GRADE FRUIT FOR SUPPLYING TO THE PUBLIC.

The use of a small box is recommended for this class of trade. A box holding 4 lb. to 6 lb. of fruit is desirable. Only sound berries should be packed. The fruit should not be stalked as it may be necessary for the retailer to hold the fruit during a quiet sales period. Each box should be lined with grease-proof paper before the fruit is placed therein. The net weight of fruit should be stamped on the end of the box. For supplies direct to the factory, containers may be obtained from the Committee of Direction of Fruit Marketing, Turbot street, Brisbane, with full instructions as to the quality of fruit required. As factory quality varies from year to year it would serve no useful purpose to describe present standards in this booklet.

Plate 132.

A Ripening Harvest.

Acknowledgment.

Thanks are due to Mr. Coxhell, of Chevallum, for permitting the use of his fruit, and also the Eudlo District show exhibitors at Nambour who supplied the box of fifteen pack.

Some Tropical Fruits.

No. 17. THE SAPODILLA.

S. E. STEPHENS, Northern Instructor in Fruit Culture.

THE Order Sapotaceæ contains a number of species, producing edible fruits; but the best known, and most highly esteemed, is the Sapodilla (*Achras sapota*, L.).

This fruit is a native of tropical America, in some parts of which it is reported to be growing abundantly in a wild state. From that region it has spread throughout most tropical countries. However, in spite of being regarded as one of the best indigenous tropical fruits of America, its cultivation has not been undertaken extensively in many other countries. Possibly the difficulty of propagation, and the very slow rate of growth, have been limiting factors in its commercial cultivation.

Macmillan states that the Sapodilla was introduced to Ceylon about 1802, but is met with yet only occasionally. In Queensland the writer knows of only one large tree and several small ones. One large tree also is growing in the Botanic Gardens at Rabaul, New Guinea. The Queensland specimen, although nearly twenty years old, has not fruited yet, but the New Guinea tree was bearing regularly for some years, although it has failed during the last year or two. The Queensland tree produced a crop of blooms early this year but shed them all. Possibly next year it may set some fruits.

The Sapodilla, as already mentioned, is slow growing, and trees raised from seed usually require about two years in the seed-bed and nursery before they are large enough to set out in the field.

The tree is of upright habit and forms a compact, shapely head. The dark green, glossy, and rather leathery leaves, of three to four inches in length clustered at the ends of the branchlets, give the tree an attractive appearance.

Authorities differ as to the dimensions attained by the tree. Whilst one quotes it as a small tree of 20 to 30 feet, another speaks of it as attaining to 50 to 75 feet. The Queensland specimen of fifteen to twenty years old is only about 15 feet high.

The flowers are small and white, and are produced in the leaf axils near the ends of the branchlets. In Queensland the flowering season was observed to be January-February. Whether a second crop will be produced here in the year, as is the case in several other countries, is yet to be proved. It is reasonable, however, to expect that trees in North Queensland will carry two crops annually, as climatic and soil conditions are not vastly different to other tropical countries.

The fruit are reported to vary in size and shape on different trees; but are commonly from round to ovoid, up to about 3½ inches in diameter. The thin, russet-brown skin contains, when ripe, a yellowish brown, translucent, sweet flesh in which the shining black seeds are embedded. The fruit is a dessert one and seldom is prepared in any way. When thoroughly ripe it is said to be of delicious flavour; but, if not properly mature, it contains a milky latex which renders it unpalatable.

The plant is raised usually from seed which takes about five weeks to germinate. Vegetative methods of propagation have been tried in

various countries, but do not appear to be too reliable. Budding has been tried in America, and grafting, inarching, and layering in India, whilst in New Guinea marcottage is applied, and in Trinidad cuttings have been struck in special striking chambers. However, in spite of the multiplicity of methods used most authorities agree that vegetative propagation is difficult.

Plate 133.
Sapodilla Tree—A Queensland Specimen.

In Mexico and Central America the Sapodilla is grown largely for the production of a gum called Chicle Gum, which exudes from the trunk of the tree when incisions are made in the bark. Chicle gum forms the basis of chewing gum, the confection so popular in America. The production of the gum is quite an important industry in the countries mentioned, and Macmillan reports that the annual export from Mexico amounts to over 2,000 tons.

In addition to the term Sapodilla, this fruit is known also as Chico and Naseberry, whilst botanical synonyms of *Achras sapota* are *Sapota achras* (Mill) and *Sapota zapotilla* (Coville).

Cabbage-growing for Market.

C. N. MORGAN, Inspector, Diseases in Plants.

THE cabbage is one of the most important vegetables for the market gardener. It grows best in the cooler districts, but by selecting varieties carefully the crop may be grown in most parts of Queensland.

The seed should be sown in beds of well-drained, deeply and thoroughly worked soil. The soil, if heavy, should be improved by the addition of sand or decayed vegetable manure, and if poor and sandy the addition of a loamy soil or well-rotted manure will be beneficial.

The surface of the bed should be fertilized and firmed, and the seed sown thinly in shallow drills about 4 inches apart. After sowing, the bed should be mulched with well-rotted leaf mould to prevent excessive evaporation of moisture.

The seed-bed must be watered regularly, for a check in the growth of young seedlings is followed frequently by unsatisfactory results.

When large enough to handle, the seedlings should be thinned to an inch apart, for if grown too thickly they develop into long, spindly, weak plants.

Shading during the hottest part of the day is necessary in many cases; but this shade should be removed as soon as the plants are strong enough to withstand the heat. Overshading also produces spindly plants. Approximately 1 lb. of seed will provide sufficient plants for an acre of cabbage.

In about six weeks the young plants should be large enough for transplanting, and then can be hardened off by restricting water supplies for a day or two before their removal to the field. Transplanting should be done in cloudy or showery weather, but if conditions are not quite favourable the young seedlings should be watered in, and, as a further precaution, the top half of the leaves may be trimmed off to lessen transpiration until the root system is established.

The loosening of the soil in the seed-bed with a fork before lifting the plants helps to save many of the small roots. If the bed has been well soaked previously, the plants will lift with a ball of soil adhering to the roots, and this will help to keep them moist.

The roots of the young plants should be kept damp after removal from the bed by standing them in a bucket containing a puddle of soil and water.

In planting, a hole is first made in the ground with a dibble—an old spade or digging fork handle is suitable. The hole should be only deep enough to allow the roots of the seedling to reach the bottom of the hole. A little earth should be turned in and the plant drawn slightly upwards before pressing the soil firmly around it. This ensures that the main root will not be doubled up.

The plants should be in rows 3 feet apart. In the rows the smaller varieties should be spaced 2½ feet and the larger varieties 3 feet apart. The growth of cabbages should not be checked on any account, and for that reason regular cultivation and watering are essential.

Correct varieties should be selected for different times of the year. Winter-planting types should be early and quick maturing.

In the cooler areas, seed of the early varieties is sown during the months of February, March, and April. Main crop varieties are sown between August and December. The coastal districts are suited best to the winter crop, and seed for the main crop is planted generally during December and January.

Cabbage should be marketed as soon as possible after cutting, and only those having good firm hearts placed on the market. Care in handling is essential, and when packed in bags for railing they should be packed as firmly as possible.

Recommended varieties are as follows:—

Early.—Early Allhead and Early Drumhead, both of which are large, early, and quick growers.

Main Crop.—Succession is the most popular variety, and may be grown almost at any time. It is a good large Drumhead type.

Surehead is slightly larger than Succession. It is hardy, and may be planted closer in the rows, as it has fewer outside leaves.

A USEFUL IMPLEMENT.

A useful implement for levelling cultivated land, breaking sods and spreading

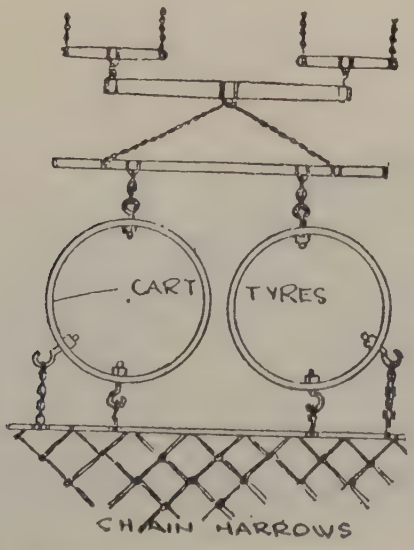


Plate 134.

cow manure, can be made from two old cart tyres, joined with ringed bolts and with hooked bolts for attachments. Any handy man can make these, and with the chain harrows attached they will do splendid work.

Plate 135.
Banana Country, South Coast District, Queensland.

Plate 136.
A North Coast Banana Plantation, Queensland.

Establishing the Avocado Orchard.

The increasing popularity of the avocado has brought this nutritious fruit recently to the notice of the commercial orchardist, and intending planters are at present considering the preparation of land for establishing orchards.

The avocado seems to be adapted to a variety of soils, the chief requisite being perfect drainage—stagnant water at the roots is fatal. The heavier soils seem to be more favourable to the growth of the tree than light sandy loams, but where possible moist medium loams should be selected for the crop.

The climatic conditions of the coastal foothill districts of Southern Queensland are generally considered satisfactory for avocado culture. Up to the present, it has not been the general custom to irrigate avocado trees. However, a wet spring is usually followed by a good crop and a dry spring by a poor crop. During the present season, only those orchards in which watering was practised have yielded good crops. The question of supplying water to the trees during dry springs therefore should receive consideration.

Avocado trees will only thrive in frost-free, well-sheltered, warm situations. In districts where the prevailing winds are such as to interfere with the normal growth, belts of standing scrub should be retained as a protection to the orchard. As an alternative, artificial windbreaks may be required. The site should be an area of unbroken land, nearly level or with a gentle slope. Steep hillsides should be avoided on account of the danger of sustaining irreparable losses by soil erosion.

The preparation of the land should be thorough. All stumps and roots should be removed to a depth sufficient to ensure that they do not impede cultivation. The land should be skim ploughed and then cross ploughed and harrowed. In that way rubbish and roots can be collected and burnt. When the weeds are eliminated, the land should be cultivated as deeply as possible, and the soil worked down to a fine tilth. Where practicable sub-soiling is desirable, as it facilitates root development.

In Queensland, it is usual to plant on the square system, though on hillsides a form of contour planting is preferable. The trees are spaced 25 feet apart, which permits of seventy being planted to the acre. The young trees should be planted so that the point of union between the bud and the seedling stock is slightly above the soil level.

A liberal watering is necessary after planting. The ground around the young trees should be kept liberally mulched with any coarse material which is not liable to pack and form a layer impervious to air and water. Spring planting is customary, though trees planted towards the end of the wet season (February to March) after the hottest period of the year have done equally well.

Numerous varieties have been introduced into Queensland, but many have been discarded for various reasons. Trial plots recently have been planted and those varieties which promise to be suitable are being worked up and kept under observation. Although at present no definite recommendations can be made, intending planters should confine their selection to varieties such as Blakeman, Grande, Goodwood, Queen, Spinke, and Wilsonia, which from the date at present available appear suitable for coastal foothill plantings for Southern Queensland.

R. L. Prest.

VEGETABLE CROP ROTATION.

The necessity for the rotation of crops in any particular plot of land must be plain to every observant market gardener. Not only does crop production fall off when the same crop is planted several times in succession, but pests and diseases frequently become worse in each succeeding crop.

In working out any system of rotation the following general rules may be taken as a guide:—

Plants belonging to the same natural order should not succeed one another. For example, tomatoes, potatoes, and the egg plant belong to the same order, and therefore should not be grown after one another in the same land.

Plants grown for their roots or tubers should not be succeeded by others grown for the same purpose, as, for example, carrots, turnips, and beet.

Crops occupying the soil for a long period should be followed by quick-maturing crops.

The Fruit Market.

JAS. H. GREGORY, Instructor in Fruit Packing.

BRISBANE marketing arrangements during the month were unsettled somewhat by the holding of the Royal National Society's exhibition. During this period many lines of fruit always have an easement in demand, with a consequent drop in prices. Growers should bear this in mind, and just send along regular consignments, only increasing supplies when requested to do so by agents.

Showery weather has been experienced in most of the coastal districts, spoiling to some extent the keeping quality of softer fruits, such as strawberries.

Melbourne and Sydney markets have maintained values for most fruits, but green papaws and pines have been unpopular and are extremely hard of sale. It is difficult to understand why growers continue to add handicaps to the development of tropical fruit markets in the South. Queensland practically has a monopoly of tropical fruits which, if developed on the right lines, will be a great acquisition to the State. Too often we see custard apples, papaws, pineapples, and other fruits displayed for sale in Melbourne and Sydney shops in such a condition that no Queenslander would consider them as fit for human consumption. It must be remembered that from May to September the weather in Melbourne, judged on Queensland standards, is cold, and that none of the tropical fruits will ripen naturally during such weather. It is necessary therefore to have the fruit fully matured and nearly ripe before it leaves this State.

Prices on the various markets are as follows:—

TROPICAL FRUITS.

Bananas.

Brisbane.—Cavendish: Nines, to 22s. 6d. per tropical case; eights, 19s. 6d. to 22s. per tropical case; sevens, 18s. to 20s. per tropical case; sixes, 15s. to 19s. 6d. per tropical case; small, 12s. to 17s. per tropical case; bunch fruit, 3d. to 9d. per dozen.

Lady's Fingers, 2d. to 7½d. per dozen.

Sydney.—Cavendish: Nines and eights, 22s. to 26s. per tropical case; sevens, 20s. to 24s. per tropical case; sixes, 17s. to 22s. per tropical case. Inferior grades lower in price.

Lady's Fingers (in clusters), to 22s. per case.

Melbourne.—Cavendish: Nines and eights, 23s. to 24s. per tropical case; sevens, 21s. to 22s. per tropical case; sixes, 19s. to 20s. per tropical case.

Pineapples.

Brisbane.—Smooths, 4s. 6d. to 7s. per case; 1s. 6d. to 6s. per dozen. Ripleys, 4s. to 6s. per case; 1s. to 4s. per dozen.

Sydney.—Smooths, 8s. to 11s. per case.

Melbourne.—Smooths, 8s. to 11s. per case.

Papaws.

Brisbane.—Yarwun, 6s. to 10s. per tropical case; Gunalda, 5s. to 6s. per bushel case; Locals, 2s. 6d. to 5s. per bushel case.

Sydney.—12s. to 16s. per tropical case. Green fruit unsaleable and not wanted.

Melbourne.—14s. to 16s. per tropical case. Green fruit unsaleable.

Custard Apples.

Brisbane.—4s. 6d. to 6s. per half-bushel. Supplies of this fruit are now falling off, and prices should remain firm.

CITRUS FRUITS.

Oranges.

Brisbane.—Commons, 5s. to 8s. per bushel; navels (mostly New South Wales), 8s. to 10s. per bushel.

With increased supplies from New South Wales the market for oranges has shown a tendency to ease.

Mandarins.

Brisbane.—Glens, 6s. to 13s. per bushel; Gayndah Glens, 12s. to 14s. per bushel; Emperors, 6s. to 12s. per bushel; Scarlets, 6s. to 12s. per bushel.

Many poor lines of Glens have been marketed, the fruit being past its prime and showing a tendency to dryness. Some small lines of Ellendales have been sent from Gayndah; the fruit was of excellent quality and realised up to 18s. per case.

Sydney.—3s. to 7s. per bushel.

Melbourne.—5s. to 12s. per bushel.

Grape Fruit.

Brisbane.—6s. to 9s. per bushel; specials higher.

Sydney.—4s. to 10s. per bushel.

Melbourne.—4s. to 10s. per bushel.

Lemons.

Brisbane.—Gayndah, 11s. to 14s. per bushel; Benyenda, 13s. to 15s. per bushel; locals, 5s. to 9s. per bushel; southern, 5s. to 9s. per bushel.

Sydney.—2s. to 5s. per bushel.

Melbourne.—4s. to 9s. per bushel.

OTHER FRUITS.

Passion Fruit.

A strong demand exists for lines of first-class fruit. Many growers still make the mistake of packing together smooth and crinkled fruit.

Brisbane.—First grade, 8s. to 10s. per half-bushel; seconds, 5s. to 7s. per half-bushel; specials higher.

Sydney.—4s. to 10s. per half-bushel

Melbourne.—2s. to 6s. per half-bushel; a few specials higher.

Strawberries.

Brisbane.—4s. 6d. to 9s. per dozen boxes.

Sydney.—3s. to 5s. per tray; 7s. to 11s. per dozen boxes.

Berries are not keeping as well as usual, and growers are strongly advised to exercise every care when packing to eliminate any damaged fruit.

Cape Gooseberries.

Brisbane.—6d. to 7d. per lb.

Many lines show a high percentage of green fruit mixed with the coloured. This can be avoided, and the value of the fruit will be raised accordingly.

Tomatoes.

Brisbane.—A sharp rise in the price of tomatoes occurred at the beginning of the month, up to 7s. per case being paid. Prices eased slightly after this, but remained firm at from 4s. to 6s. for really good fruit. Before going to press a further rise had taken place. Prices were:—Green fruit, 2s. 6d. to 6s. per half-bushel; ripe fruit, 2s. 6d. to 6s. per half-bushel; coloured, 3s. to 8s. per half-bushel.

Sydney.—Queensland fruit 4s. to 7s. per half-bushel. Western Australian fruit is expected shortly; so there is a possibility of prices easing slightly, although good fruit will maintain its value.

Melbourne.—Adelaide hothouse, 7s. to 10s.; Western Australian, 4s. to 8s. Large consignments of Western Australian fruit are expected.

Apples.

Brisbane.—Southern fruit: Jonathan, 6s. to 9s. per case; much inferior fruit is on the market, and is hard of sale at from 3s. to 5s. per case; Granny Smith, 5s. to 9s.; Sturmer, 4s. to 6s.; French Crab, 5s. to 6s.; Democrat, 6s. to 7s. 6d.; Rome Beauty, 6s. to 8s.; Yappeen, 7s. to 8s.

Many poor lines of fruit are to be seen on the Brisbane market at present, causing a general reduction in prices. The weather is now beginning to warm up; so Southern growers should take care to send only suitable varieties to this market.

Pears.

Brisbane.—Coles, 9s. to 11s. per case; Nelis, 7s. to 12s. per case; Josephine, 9s. to 13s. per case.

Occasionally consignments of pears arrive unwrapped. These lines inevitably open up specky. All pears for this market must be wrapped in order to arrive in good order.

VEGETABLES.

Cucumbers.

Sydney.—8s. to 12s. per bushel.

Carrots.

Sydney.—6s. to 8s. per cwt.

Beans.

Brisbane.—11s. to 15s. per sugar-bag.

Peas.

Brisbane.—7s. to 10s. per sugar-bag.

Lettuce.

Brisbane.—6d. to 1s. 6d. per dozen.

PUBLICATIONS.

A pamphlet on the marketing of strawberries is now available for distribution. "Harvesting and Packing Peaches and Nectarines" may also be obtained, together with a packing chart.

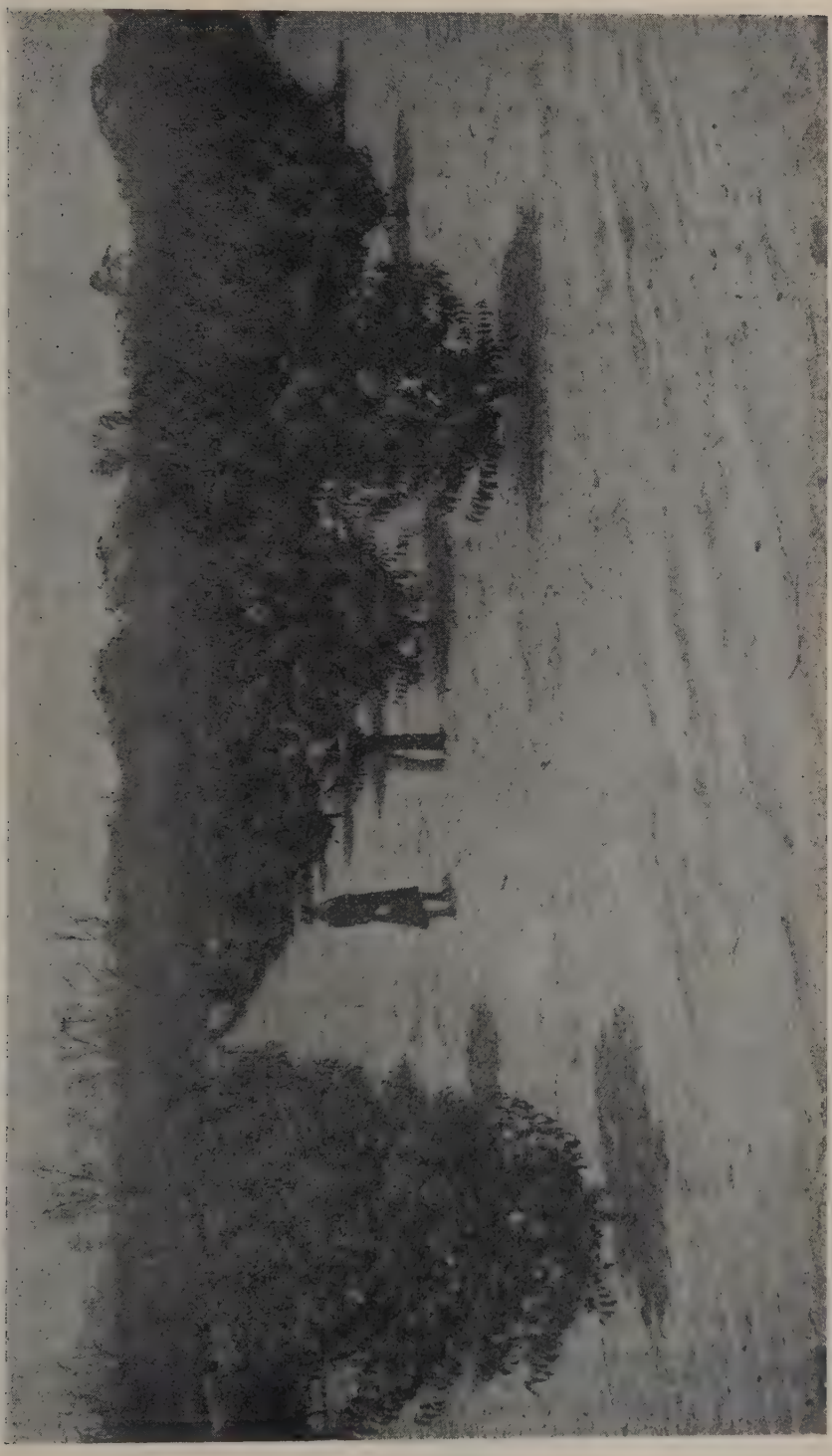


Plate 137.
A Peach Orchard, Bapaume, Stanthorpe District, Southern Queensland.

Plate 138.
Blossom Time in the Peach Orchard.

Plate 139.
Peaches ready to pick.

Plate 140.
In the Peach Growing Country, on the road to Glen Niven, near Stanthorpe.

SUITABLE COTTON VARIETIES FOR THE 1937-38 PLANTING.

R. W. PETERS, Acting Director of Cotton Culture.

The bulk of the requirements of the Australian spinners for the coming season will be for cottons of $\frac{1}{16}$ to $1\frac{1}{16}$ inches in length. This will necessitate a greater growth of varieties producing these staple lengths than has been the custom in the past. The following recommendations therefore are made to assist farmers who have not grown such cottons before in selecting the most suitable variety of this type for their soils.

The best variety producing the shorter cottons on the alluvial soils of fair to good fertility in the Southern district and the South and Central Burnett districts appears to be the Half and Half, which has yielded very well in these areas during the last two seasons. It has not done well in trials in the Callide Valley, and cannot be recommended for that area. It has a medium-sized boll, which picks well when the variety is grown under favourable conditions, yields cotton around $\frac{15}{16}$ inches in length, and has a lint percentage of approximately 40. It should not be grown on soils of low moisture retaining ability, for adverse conditions markedly reduce the size of the bolls and the quality of the lint.

The Lone Star variety appears to be the outstanding cotton for most of the clay loam soils of the lower slopes originally covered with ironbark and box trees of the forest series; and brigalow, brigalow-wilga, and brigalow-belah of the scrub series. For several seasons this variety has yielded satisfactory returns on such soils in the Maranoa, the South, Central, and Upper Burnett, and the Callide Valley districts. It is rather a vigorous grower on fertile loamy soil, however, and therefore should not be planted on alluvial loams in districts likely to experience heavy mid-seasonal rains. It has large, well opened, easily picked bolls, produces fibre from $\frac{15}{16}$ to $1\frac{1}{16}$ inches in length, according to soil and climatic conditions, and yields around 36 per cent. lint for the bulk stocks, and up to 38 in some of the newer developed strains. It is undoubtedly a variety well suited for many of the districts, and should be grown wherever possible, as the lint is in great demand by the spinners.

Another big-bolled cotton that should be grown to the fullest extent is the Miller variety, which has given excellent results on the clay loam soils of the lower forest and scrub slopes, as well as on the alluvial clays of moderate fertility in the Wowan, Callide Valley, Upper Burnett, South Burnett, and Southern districts. It is earlier fruiting than Lone Star and can, therefore, be planted on more fertile soil, but requires greater moisture than does the latter variety, thus making it a better cotton for the heavier soils of the slopes in the coastal areas. The bolls are very large, and are picked with exceptional ease, particularly on cultivations following grassland; the fibre is the fullest bodied of any cotton grown here, and averages around an inch in length, with a 35 lint percentage. As a rule rather high grades of lint are obtained with Miller, for the fibres clean up well in the ginning operations.

Cliett is a big-boll variety that competes with Lone Star and Miller under certain specialised conditions, but is not recommended for distribution except where carefully conducted tests have indicated its superiority.

Mebane is a nice type of big-boll cotton that produces excellent fibre on sandy soils overlying clay in the drier districts and on the harder clay melon-hole soil types of the brigalow scrub, where it gives very satisfactory results. It is not suited to the better soil types, however, owing to a tendency to make rank growth on such soils under good rainfall. Under suitable conditions it is a good picker, with a 38 lint percentage, and produces fibre ranging from 1 to 1 $\frac{1}{16}$ inches in length.

The most promising of the shorter cottons for the fertile alluvial loams in the Upper Burnett, Callide Valley, and Wowan districts appears to be the Ferguson variety, which has yielded well in varietal tests, and many of the commercial trials during the last two seasons. It is a relatively new variety, but appears to have distinct possibilities of supplanting the Durango, Starvale, and Indio Acala varieties in these areas, particularly if it is grown on new or grassland cultivations. It produces a nice style of $\frac{15}{16}$ to 1-inch cotton, has a 37 lint percentage, and a boll of medium size which opens and picks well.

It also will be necessary to produce a reasonable amount of 1$\frac{1}{8}$-inch cotton, and farmers who have obtained satisfactory yields of high-grade cotton with Durango and Indio Acala should continue to grow these varieties. It is advised, however, that there is little market for the softer or yellow-spotted grades of these longer cottons, and where growers have received mostly yellow-spotted grades they should try either Miller or Ferguson, for apparently their conditions are not suitable for the longer cottons. It is stressed though, that there is a bigger factor of safety for obtaining satisfactory yields of cotton of good quality from all varieties, during the first three or four seasons following the breaking up of grassland. After that, the changes in the chemical and physical condition of the soil that occur with further cotton cultivation make it necessary that the varieties be selected very carefully to suit the soil and climatic conditions.

It is strongly recommended that when in doubt as to the best variety, the farmer should apply for advice either to the field officer of the cotton section of the Department of Agriculture, stationed in his district, or direct to the Department of Agriculture and Stock, Brisbane, for a large amount of evidence has been collected as to the merits of the different varieties which would be of assistance in determining the best variety, if the soil type is described.

Plate 141.
Crop and Pasture Land near Killarney, South Queensland.

MILLETS IN CENTRAL QUEENSLAND.

W. R. STRAUGHAN, Instructor in Agriculture.

Owing to the absence of winter rains many dairy farmers have areas of cultivated land under fallow which they were unable to plant with winter cereals, and now that the period for the planting of such crops is past some alternative summer growing feed undoubtedly is needed. The quickest growing fodder crops are the millets. Since the preparation of the land for winter cereals has been shallower, probably, than that necessary for maize and sorghums, millets should give the most profitable returns.

The millets—Japanese, white panicum, and giant setaria or giant panicum—are hardy plants and stand dry conditions well. They are quick growing, and have supplied material for grazing within six weeks of planting. These plants, however, should not be grazed before the roots are sufficiently strong to avoid their being pulled up by stock; and where judiciously grazed under favourable weather conditions, a good ratoon crop may be expected of them.

Where the green feed is not required, millets make a good quality hay if cut when the seed heads are formed and before the seed has developed. A delay in cutting occasions loss in several ways, and it is better, if there is any doubt as to when the crop is to be cut, to err on the side of greenness rather than otherwise. If cut too green the hay may cause a slight scouring of stock; but if it is too well matured a loss of digestible plant nutrients will result. Further, if such a free-seeding crop is allowed to mature the scattered grain will cause trouble in subsequent crops by the resultant volunteer growth, and the seed, if carried into the haystack or shed, provides food for mice.

Quite frequently, with a desire to attain balance in their stock feeds, farmers have sown cowpeas with the millets very successfully, thus increasing the protein content of their fodder and so improving their cream returns.

Millets, also, especially in combination with coarse-stalked crops—such as maize and sorghum—make excellent silage, and since they produce 10 to 12 tons of green material to the acre under good conditions they may be used most advantageously for that purpose.

Millets prefer a loam for maximum growth, but will grow on a wide range of soils; even poor lands, if sufficient moisture is present, will give payable yields. Early sowings can be made as soon as frosts are over and can be continued successfully until January and February. Only small areas should be planted in November and December to provide grazing, as the heavy summer rains in January are apt to prevent the harvesting of any surplus as hay.

For sowing 10 to 12 lb. of seed per acre are usually sufficient when broadcast and harrowed in. When sown for hay, or on rich soils, a heavier seeding (about 15 lb.) is frequently used with a view to producing a fine-stemmed crop. Too heavy a seeding (over 20 lb.), however, will not have this effect, since—especially during a short dry spell—the original stand is quickly reduced by competition sometimes even to meagre proportions.

Of the varieties white panicum is undoubtedly the most popular. A quick grower, it stools well and reaches a height of from 4 to 6 feet. It has a flat stem and makes a good bright hay of some commercial value. Japanese millet is slightly shorter in its mature growth, but is—especially in the earlier stages—an even quicker grower and heavier stooler than white panicum, and is most suitable for grazing. Giant setaria (or giant panicum) has also received some attention, and under favourable conditions good results are obtained. Under adverse conditions, however, it does not appear to give as good results as the other varieties.

The millets are also very useful in controlling summer weed growth, but, of course, should be taken out before the time arrives to begin preparing the land for autumn planting.

THE SACCHARINE SORGHUMS.

N. A. R. POLLOCK, Senior Instructor in Agriculture.

The saccharine or sweet sorghums provide a great bulk of nutritious fodder palatable to all classes of stock, and their general hardiness should commend them to all farmers seeking a sustained supply of stock food. They may be grown successfully throughout the State, and, while maize is popularly considered to be more nutritious, the difference of food unit values is very small and more than outweighed by the increased quantity of fodder usually produced by the sorghums.

Maize quickly deteriorates on reaching maturity or under dry weather conditions. The sorghums, however, are more retentive of their succulence. Even after frost the stems retain their characteristic sweetness, and this, especially when the crop has been planted in February or early March, ensures a supply of succulent feed for the early winter months. They will grow in a great range of soils, and, although slower of germination than maize and consequently more difficult to keep clean in the early stages of growth, will withstand even prolonged dry periods when established, and following such periods will make quick response to any favourable weather changes.

As a silage crop they are second in value only to maize, and under dry conditions their added succulence makes them even preferable. Sorghums, like other crops, make their maximum growth only when the land has been thoroughly prepared. When the food supplies require to be augmented rapidly planting on incompletely prepared soil may be excusable, but generally speaking that procedure is not regarded as good farming.

Sowings may be made either broadcast, when 10 to 12 lb. of seed per acre will be required, or in drills at the rate of 4 to 6 lb. of seed, according to the quality of the soil and the fineness of stem desired. Planting in drills is preferable, for although it is frequently claimed that broadcast crops have the advantage of being finer stemmed they are usually shorter of stature, and the average yield is generally lighter and harvesting more difficult. Sowing in drills allows of inter-row cultivation —a distinct advantage. Cultivation should be regular enough to check weed growth, and thus conserve moisture, and should be progressively shallower to avoid root damage. A maize drill fitted with sorghum plates is quite suitable for sowing. A wheat drill, with appropriate outlets blocked, is also quite convenient. Failing a seeding machine the drills usually are opened by a plough or scuffler and the seed is dropped by hand and covered by the harrows.

The crop should be harvested when the seed has formed, and is commencing to harden, usually three to three and a-half months after sowing. In small areas harvesting is usually done by hand with a cane knife. In large acreages such a method is too slow and laborious and if a maize binder is not available, a sledge cutter will be found most convenient. Such a cutter can be made on the farm, and particulars regarding it are obtainable from the Department of Agriculture and Stock. It can be drawn by one horse. Light crops may be cut with a mower or harvested with a reaper and binder.

Stock should not be allowed access to the sorghums during the first few weeks of growth, or after a check due to dry weather. They can be fed safely when mature, or even earlier, provided that the fodder is allowed to wilt for a day or so after it has been cut. The risk of poisoning can be minimised by feeding molasses with the fodder.

Saccaline undoubtedly is the most favoured variety. Good crops attain a height of 10 to 12 feet and the stem is only moderately coarse. It is the most frost-resistant of the varieties under general cultivation, is sweet flavoured, and the seed is easily procured. White African is a very quick-growing variety in its early stages; but it is later in maturing. The stem tends to coarseness. It, however, is a very heavy yielder, although not quite so succulent as saccaline. It stands frost well.

Imphee or Planter's Friend is very similar to saccaline—though generally not so vigorous a grower.

Honey, an American importation, grows to a height of over 12 feet. The stem is thick, but it is particularly well supplied with juice of a characteristic sweetness. Some exceptionally heavy crops of this variety have been obtained, but seed is difficult to procure and the crop does not resist frost well.

Other varieties include Early Amber, a fine pithy-stemmed, early maturing variety which has gone out of favour; Collier, a fairly fine-stemmed variety yielding well; and Cowper, a moderately early crop, giving very useful yields.

COWS ARE QUIETER WHEN DE-HORNED.

When properly and humanely done, the after effects of de-horning is scarcely noticeable in dairy cows. For a few days they may give a little less milk, but after that they quickly return to full production. They are quieter in the yard and no longer are in continual terror of attack from bullies at milking time. Contentment leads naturally to improved production.

Brisbane Exhibition, 1937.

Plate 142.

THE SHOW STOCK MUSTER FOR THE GRAND PARADE.—The Brisbane Exhibition provides one of the finest stock shows in the Commonwealth. Many of the leading families of the British breeds of cattle and horses—some from famous stud establishments in the United Kingdom—were represented worthily in the ring. The daily parade of the aristocrats of Queensland herds around the arena was among the most popular events of the Show.

Plate 143.

The Opening Ceremony at the Brisbane Show.—His Excellency the Governor-General, Lord Gowrie, V.C., P.C., K.C.M.G., D.S.O., inspecting his Cavalry Escort and Naval Guard of Honour.

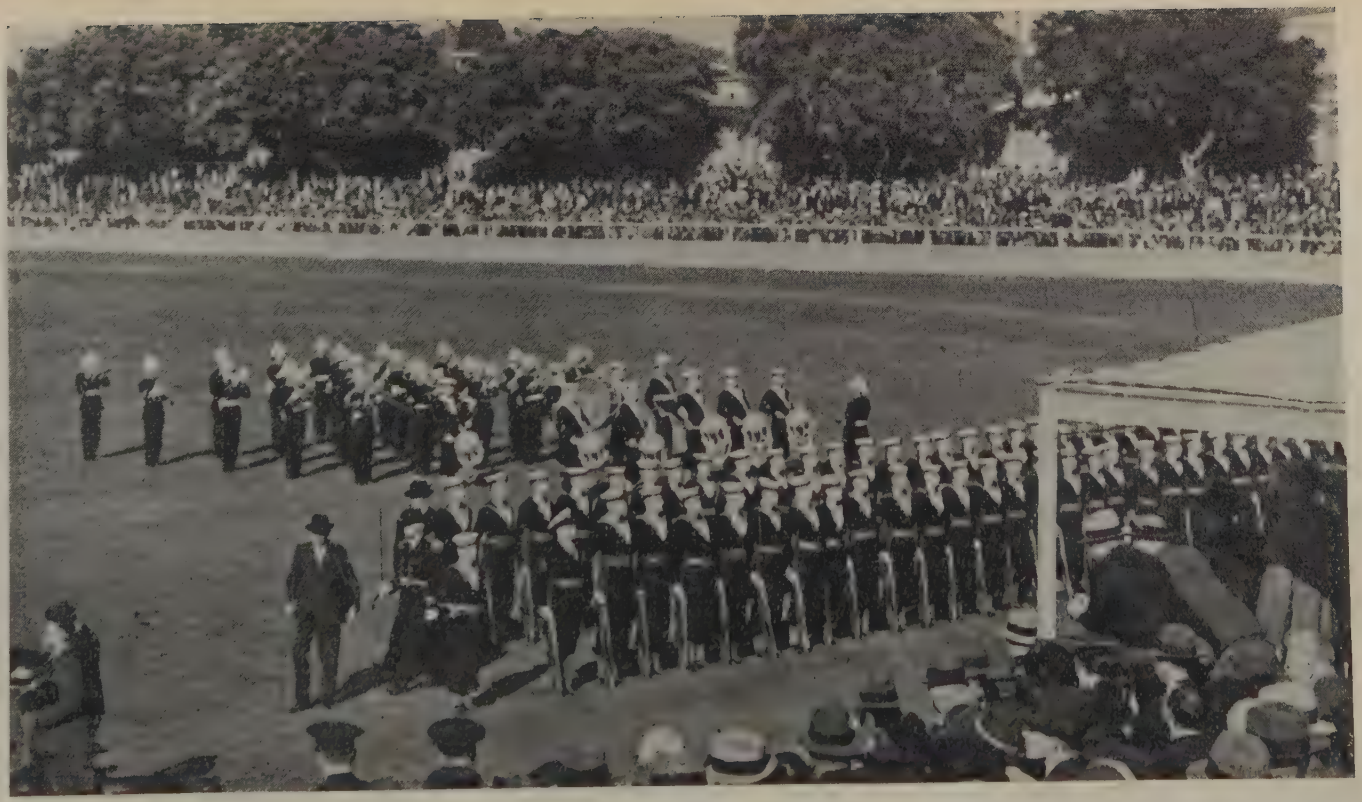


Plate 144.

The Governor-General's Naval Guard of Honour from the Royal Australian Navy at the Opening of the Royal National Show, Brisbane, on 18th August.

Plate 145.

The Governor-General's Cavalry Escort.—This troop of Australian Light Horse (Volunteer Militia) consisted of men from the country who are engaged actively in rural industry.

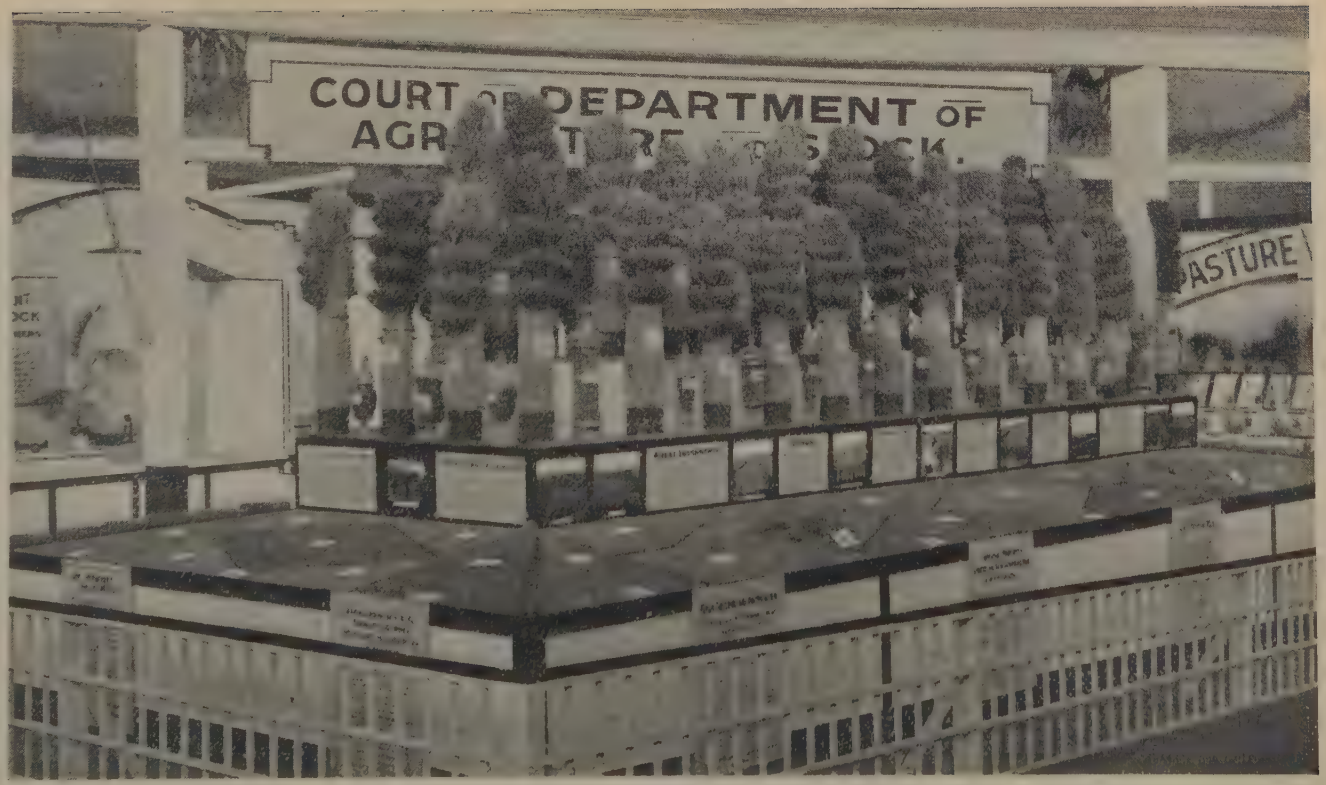


Plate 146.

THE WEALTH OF QUEENSLAND'S GREAT GRAIN REGION.—The central trophy in the Court of the Department of Agriculture and Stock was evidence of the plant breeders success in evolving wheats suitable to Queensland conditions of summer rainfall. It illustrated also the progress made in maize production and the propagation of new varieties.

The whole lay-out of the Court was a credit to the designer, Mr. Stanley Burchill, of the Agricultural Branch.

Plate 147.

PRODUCTS OF A FRUITFUL COUNTRY.—Excellent specimens of the numerous temperate and tropical fruits grown commercially in Queensland were included in this impressive display of the Fruit Branch. Working models of various mechanical contrivances used in the orchard and packing shed added to the interest of a great exhibit.

Plate 148.

"ALL FLESH IS GRASS."—A striking panel of pasture grasses emphasised the truth of the Scriptural dictum. Probably 80 per cent. of Queensland's wealth is derived from nutritious indigenous and introduced grasses.

Plate 149.

A DISPLAY OF GRAIN SORGHUMS.—In Queensland a considerable area is sown annually with sweet or feed types, which are valued as fodder and silage—suitable varieties being Saccaline, White African, and Imphee. The grain types are not grown to a similar extent, but in view of their capacity to yield heavy crops of nutritious grain under severe climatic adversity, which would be fatal to successful maize production, it is considered that a larger area could be cultivated for grain. An alternative feed grain produced economically would be welcomed by the pig and poultry industries.

Plate 150.
QUEENSLAND'S WEALTH IN FINE MERINO FLEECES.

Plate 151.
QUEENSLAND LINT FOR AUSTRALIAN LOOMS.—High spinning quality is a characteristic of Queensland fibre. The Cotton Alcove contained impressive evidence of the importance of a new and staple industry.

Plate 152.

PRODUCE FROM ST. LUCIA FARM SCHOOL.—A corner of the Court of the Department of Agriculture and Stock in which was displayed samples of crops produced by city boys undergoing training for a country career. A free six months' practical farming course for youths and young men is available at St. Lucia. A thorough grounding in the rudiments of every branch of farm work is given amid beautiful rural surroundings on fertile land fronting a reach of the Brisbane River. At the end of the course a farm job for every trainee is guaranteed. Farmers' demand for St. Lucia trainees is far in excess of the number of boys available. This fact is a further demonstration of the practical value of the training that the Farm Training School provides.

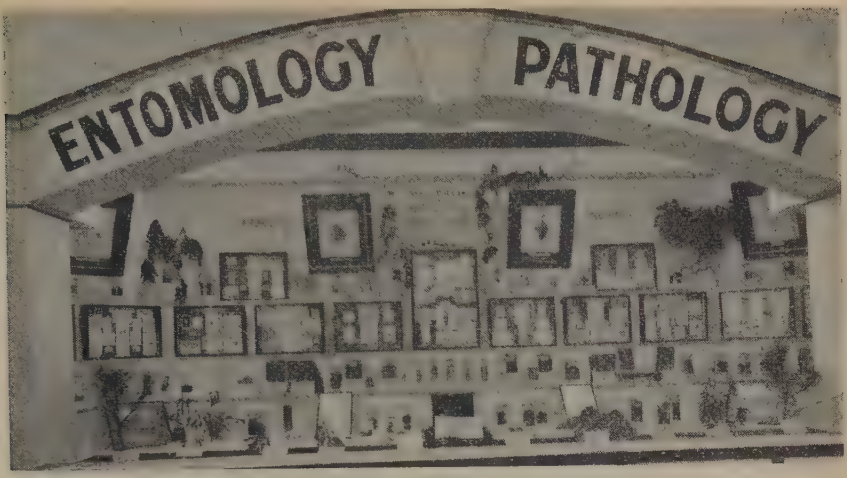


Plate 153.

Science Serves the Farmer.—The place of Economic Entomology and Vegetable Pathology in Rural Economy was shown in a striking way by this well-arranged display.

Plate 154.

A Model Pig Farm.—Complete in every outdoor detail, in an alcove of the Departmental Court was a centre of popular interest. Pig raising is a firmly-established and rapidly-expanding industry in Queensland. An export trade in frozen and chilled pork has developed remarkably in recent times. Throughout the year an active educational campaign on carried on, and this display illustrated the effectiveness of that work.

Plate 155.

A MODEL POULTRY FARM was the central feature of this interesting exhibit. The poultry industry in Queensland is now approaching £1,000,000 in annual value.

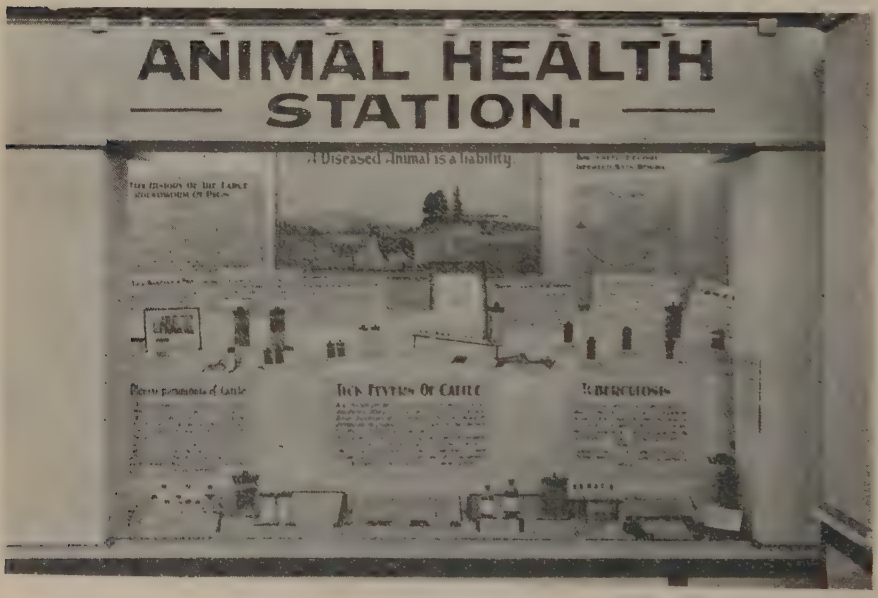


Plate 156.

"A DISEASED ANIMAL IS A LIABILITY."—Some of the activities of the Animal Health Station at Yeerongpilly were illustrated impressively and effectively in this corner of the Agricultural Court.

Plate 157.

THE JOURNAL ALCOVE IN THE DEPARTMENTAL COURT.—A rendezvous for visitors from the agricultural districts of the State, both far and near. Arthur F. Crees and Tom Stevenson are the young officers in charge. Other officers associated with the several divisions of the Department of Agriculture and Stock were in attendance to advise show visitors on matters connected with the exhibits and the laboratory and field work of the Department generally.

Plate 158.

TO GO UP IN SMOKE.—The high standard of quality of Queensland leaf for pipe, cigar, or cigarette was well exemplified in this array of exhibits representative of every tobacco-producing district in the State.

Plate 159.

WEST MORETON WINS AGAIN.—Pillars and arches of sugar cane, blending in well toned tints, were included in the decorative features of the A Grade District Exhibit, to which was awarded the place of honour. Pastoral, agricultural, mineral, and industrial products from one of Queensland's most progressive provinces were assembled in one comprehensive display.

Plate 160.

The Agricultural and Mineral Wealth of the Central Burnett.—Pillared, panelled and pallisaded with multi-coloured sugar cane, and replete with the products—all of a high standard of excellence—of the field, factory and farm home, this exhibit from the Gayndah district was a striking representation of the industry and the richness of natural resources that made it possible.

Plate 161.

THE WEALTH OF WOOMBYE FRUIT LANDS.—This fine display of temperate and tropical fruits typified the wide range of horticulture practised successfully on the near North Coast.

PRODUCTION RECORDING.

List of cows and heifers officially tested by Officers of the Department of Agriculture and Stock which have qualified for entry into the Advanced Register of the Herd Books of the Australian Illawarra Shorthorn Society and Jersey Cattle Society, production charts for which were compiled during the month of July, 1937 (273 days unless otherwise stated).

Name of Cow.	Owner.	Milk Production.	Butter-Fat.	Sire.
		Lb.	Lb.	
AUSTRALIAN ILLAWARRA SHORTHORNS				
SENIOR, 3 YEARS (OVER 3½ YEARS), STANDARD 290 LB.				
Model VI. of Alfa Vale (365 days)	W. H. Thompson, Alfa Vale, Nanango	14,251·1	592·462	Reward of Fairfield
JUNIOR, 3 YEARS (UNDER 3½ YEARS), STANDARD 270 LB.				
Laguna Venus II.	F. G. Lamkin, Moola, Dalby	8,759·45	344·819	Morden Marcus
Glenore Ginger (272 days)	A. M. Johnson, Gracemere	7,204·95	274·771	Sunnyview Union Jack
SENIOR, 2 YEARS (OVER 2½ YEARS), STANDARD 250 LB.				
Glenore Heiress	A. M. Johnson, Gracemere	8,052·45	295·263	Sunnyview Union Jack
Blyth Alpha 1st	A. M. Johnson, Gracemere	7,571·6	278·413	Blacklands Headlight
JUNIOR, 2 YEARS (UNDER 2½ YEARS), STANDARD 230 LB.				
Rosenthal Milkmaid 10th	M. C. and A. M. Sullivan, Pittsworth	7,004·23	275·65	Rosenthal Carbine
JERSEY.				
JUNIOR, 4 YEARS (UNDER 4½ YEARS), STANDARD 310 LB.				
Pineview Clementine	F. Maurer, Darra	6,383·6	362·1	Buttercups Noble
JUNIOR, 2 YEARS (UNDER 2½ YEARS), STANDARD 230 LB.				
Retford's Hope of Hamilton	J. Wilton, Raceview	7,652·25	461·269	Retford May's Victor
Woodlands Fashion	D. R. Hutton, Cunningham	5,741·75	294·932	Kenmore Victor
Bellgarth Viola II.	D. R. Hutton, Cunningham	5,184·	282·961	Trecarne Renown II.
Carnation Princess Victoria	D. R. Hutton, Cunningham	4,634·77	241·714	Vincheles Golden Victory

The Tropics and Man

WATER AND SALT.

DOUGLAS H. K. LEE, M.Sc., M.B., B.S., D.T.M., Professor of Physiology, University of Queensland.

Second Series: No. 2.

IN the last article we saw that the skin blood-vessels dilate under hot conditions, and it sometimes happens that there is not enough blood to fill the blood-vessels, with a consequent bad effect upon the working of the different parts of the body. This condition is made worse, of course, if the amount of blood is reduced at the same time. Such a reduction must occur if the body is losing more water than it is taking in.

"Most Important Factor."

About 65 per cent. of the body is water. Man sometimes can stand a reduction to 45 per cent., but beyond this death will occur. The supply of water is a much more important factor than the supply of food in the early days of a period of privation. This was demonstrated clearly in the recent air disaster on the Lamington Plateau. This insistent demand for water is due to its unique property of dissolving a large number of substances.

Nearly all the intricate and delicate chemical processes upon which life depends are carried out in solution, and if water is taken away they must go wrong or cease altogether. We have seen also that the blood cannot circulate unless enough water is present to allow the blood to fill the vessels and to run freely in the vessels. Blood in men dying from thirst is so thick that it hardly runs from veins when they are cut. A peculiar thing is that even in these people the kidneys go on secreting small quantities of urine and continue to excrete waste products.

Points About Water Drinking.

Water is lost from the body in three ways—from the lungs in the breath, from the skin as insensible perspiration and as sweat, and from the kidneys and alimentary canal in the excreta. Under normal conditions, we drink more water than we require to replace our losses, and the excess is passed out by the kidneys. If the loss of water by one of these channels becomes excessive, as it certainly does during hard work under very hot conditions (2 lb. of sweat an hour), then the ordinary intake is no longer enough. The sensation of thirst is some indication of our need for water, but is not always a reliable guide. It is better to take enough water to prevent thirst occurring than to wait for thirst to sound the warning. The volume of urine may be reduced quite definitely without thirst being noticeable; in fact, this is the usual state of affairs in the tropics. It probably is unwise to allow the reduction in urine to continue day after day, as there is some evidence that the occurrence of "stone" is increased thereby. Another point about water drinking is that it probably is better to take small drinks frequently than large drinks periodically. The taking of a large drink causes a burst of sweating in many people, which, to a certain extent, undoes the good done by the drink. Such sweat, too, runs off the body without evaporating, and is wasted as far as cooling the body is concerned.

Effects of Dehydration.

The first outstanding effect of water deprivation upon the body's working is upon the blood circulation. The volume of blood is reduced and it becomes increasingly more difficult for the body to keep its vessels filled. As a result, all the body tissues are affected, but the nervous system is the first to show these effects. We noticed the symptoms last time—tiredness, irritability, lack of concentration, faintness. Partly through this and partly through lack of sufficient fluids, the working of the digestive system is upset. Loss of appetite, "indigestion," constipation and interference with food absorption occurs. Spices, laxatives, and alcoholic stimulants are frequently indulged in with little lasting effect, when a very simple preventive is to hand—the drinking of sufficient water. That familiar sensation of fatigue in hot weather is due in large part to lack of water. The muscles are dehydrated, their salt balance is disturbed, and the nervous system supplying them is upset for the same reasons. Usually things do not progress much beyond this stage but, even so, this stage occurs far more commonly than it need and takes a large toll in lowered efficiency and predisposition to fatigue. If dehydration progresses, however, the circulation of the blood, impaired by lack of water, often leads to disordered chemical behaviour in all the tissues of the body, so that excessive amounts of acid materials are produced, and these accumulate because the poorly-working kidneys cannot get rid of them. All these things combine in speeding each other up and forcing the body to a crisis.

Salt Loss from the Body.

The importance of salt to the body has been appreciated since the days of the primitive peoples, and its importance to men working on hot jobs was recognised early in this century. The wave of enthusiasm for the newly discovered parasites as the cause of tropical disease, however, tended to obscure its recognition by the large majority of white dwellers in the tropics. It is only recently that its full importance has been realised.

The blood contains 0·6 per cent. of salt. When one starts to sweat profusely through work in a hot atmosphere, the sweat contains only a little salt, say 0·1 per cent., but as the sweating continues, the percentage rises to that of blood. People vary a good deal in the salt content of their sweat, and one thing we are trying to discover is whether this is in any way related to their ability to withstand hot climates, and also the effects of acclimatisation. (I, for instance, have much less salt in my sweat than my London colleagues.)

Men working hard in hot climates lose a great deal of salt. This must be replaced, and in hard workers, this means the addition of a liberal amount of salt to the food.

Effects of Salt Lack.

The first effect of salt lack is the reduction of the amount of salt excreted by the kidneys. This is a protective measure and suffices for short periods. The second effect is the mobilisation of salt from stores in the body. Some people have good stores. (I was unable to exhaust mine even when I lived on a strictly salt-free diet for a week and lost several pounds of sweat each day.) Others have almost none. (The blood salt of one of my subjects fell by one-quarter while sitting in a hot room for six hours.) When these protective measures fail, the blood salt

begins to fall. When it falls about one-third, muscle cramps begin—miner's cramp or stoker's cramp. These may be most violent and excruciatingly painful, and men may die even in an attack. Dramatic relief is obtained by injecting strong salt solution.

Apart from the severe effect of marked reduction in the body's salt content, there are probably many more subtle disturbances associated with a chronic salt deficiency insufficient to produce cramps. It is thought that the failure of sweating sometimes seen in hot dry countries, as a prelude to heat stroke, is due to salt lack. It has recently been discovered that the salt and water content of the body come partly under the control of a ductless gland, known as the adrenal cortex. Extracts from this gland relieve certain cases of neurasthenia. This raises the question as to whether tropical neurasthenia is associated with chronic mild salt lack.

Rules for Prevention.

1. Take *plenty* of fluids in hot weather, especially if doing manual labour.

2. Take frequent small drinks rather than a few large drinks.

3. Use laxatives and appetising spices only with discretion; seek to remedy the cause of the trouble.

4. Add salt plentifully to the food; the body can get rid of excess, but it cannot make up a deficiency.

5. All these rules apply even more forcibly in hot dry climates.

[*Photo: P. P. Comiskey, Stock Branch.*

Plate 162.

CROSSING THE GEORGINA.—The "lead" of a mob of Brunette (North Australia) bullocks, travelling south, crossing one of the channels of the Georgina River, at the "One Mile," near Urandangie, West Queensland.

Answers to Correspondents

BOTANY.

Replies selected from the outgoing mail of the Government Botanist, Mr. C. T. White, F.L.S.

Prickly Supple Jack.

J.J.S. (Helidon)—

The specimen you sent is *Smilax australis*, commonly known as Prickly Supple Jack. It is a very common plant in Queensland, particularly on hillsides in heavily forested country. It is not known to possess any poisonous qualities.

Grasses and Weeds.

G.H. (Booinbah, via Goomeri)—

1. *Senebiera dedyma*, bitter cress. A very common weed in cultivation in Southern Queensland. It is one of the worst milk-tainting weeds we possess.
2. *Xerotes* sp., mat rush. A book, "The Principles of Botany for Queensland Farmers," shortly to be published by the Department of Agriculture and Stock, Brisbane, either free or at a small charge, will give you the difference between sedges, grasses, and rushes. You should get your head teacher to obtain a copy for your school library.
3. *Malva parviflora*, marsh mallow.
4. *Chloris divaricata*, a native chloris or windmill grass. The native chloris grasses are very valuable fodders, particularly for sheep. When closely grazed they make a thick sward.
5. *Sporobolus Berteroanus*, Parramatta or rat's tail grass. This grass is an inferior fodder. It has caused some trouble of recent years through its invasion of the better paspalum patches.
6. *Bothriochloa decipiens*, bitter blue grass. An inferior blue grass sometimes known as coastal blue grass. It dominates many pastures due to the more palatable species having been eaten out. *Setaria* sp., a pigeon grass.
7. *Dicanthium sericeum*, blue grass.
8. Seed heads required for determination.
9. *Stachys arvensis*, stagger weed, also called wild mint, not to be confused with the mint weed of the Pittsworth area, which has received so much publicity of recent years owing to its poisonous properties. The present plant is a common weed of cultivation, particularly during the winter and spring months. It is quite a good fodder for dairy cattle, calves, and resting stock. It causes staggers and shivers in working horses and also stock that are travelling.

Shade and Shelter Trees.

G.C.B. (Wandoan)—

The following shade and shelter trees may be suitable for your purpose:—Kurrajong, bottle tree, pepper tree, white cedar, sebizzia lebbek, Burdekin plum, Portuguese elm. These could be obtained from the Director, Botanic Gardens, Brisbane, the charge being 2s. per tree. It is possible that you could obtain some of these trees, or other suitable trees, from Mr. L. Burbank, a nurseryman of Chinchilla. The Department has no trees for distribution. Both the wilga and the cypress pine are ornamental trees, and excellent for shade purposes. The wilga is often eaten by stock, and is of value on that account. You may be able to obtain seedlings of these trees somewhere in your district. Specimens of plants for identification should be sent to the Government Botanist, Botanic Gardens, Brisbane.

Poisonous Plants.

W.R. (Petrie)—

Swainsona luteola is a plant related to the indigo or Darling pea, and has been proved by feeding tests to affect stock in much the same way. Animals are said to have a crazed appearance for some time after eating the plant, and they have been taken off it. It is quite common in Queensland, and has several times been sent to us as a suspected poisonous plant. We have not heard a common name given to it.

Lotus australis, the native bird's-foot trefoil, frequently called Barwon lucerne, is generally regarded as an excellent fodder plant; but, like the frost-resistant Rhodes grass, sorghums, and some other plants, contain a prussic-acid-yielding glucoside. Losses from it among ordinary paddock stock, however, are rare. It is moderately common in Queensland, but little trouble with it has been experienced.

Under Suspicion.

L.L.M. (Charleville)—

1. *Euphorbia Drummondii*, caustic weed. This plant has been found to be cyanophoric in New South Wales, but repeated tests with Queensland specimens have always yielded negative results. Symptoms as almost given universally by stockowners are not those of typical HCN poisoning. The head and neck of the affected sheep swell considerably. If this swelling is pierced and an amber-coloured fluid exudes, the life of the sheep may be saved.

2. *Cucumis myriocarpus*, paddy melon. A native of South Africa now widely spread in many countries. It is a very common weed in Queensland. Both in Queensland and New South Wales it is said to have caused blindness in horses. So far as we know nothing definite has been proved against the plant in Queensland. In South Africa the juice has been found to be toxic.

3. *Eremophila maculata*, native fuchsia. A very common plant in many parts of the West. It is strongly cyanophoric. Most losses with it, however, as in some cases of cyanogenetic plants, seems to be from travelling stock, ordinary paddock resting stock frequently browse on the plant with impunity. In fact, most graziers look on it as quite a good fodder.

"Very Poisonous."

E.K. (Cunnamulla)—

Your specimen represents a species of *Datura* or thorn apple. It is difficult to say from a single leaf what actual species it is, but it looks like the common garden species, *Datura Cornucopia*. All species of *Datura* are very poisonous, and if your cows and calves had access to some of these plants, and have eaten any of them, it is more than likely they are the cause of the trouble.

Hog Weed.

M.R.M. (Mundubbera)—

The specimen represents *Trianthema decandra*, frequently known as hog weed, which is very common in Queensland. It is not known to possess any poisonous properties, and so far as we know has not come previously under suspicion as a poisonous plant. It belongs to a wholesome family of plants (*Aizoaceæ*), closely allied to the pig weeds. Some of the smaller members of the genus *Trianthema* are very common on the Western pastures, and are looked upon as quite good cattle feed.

Species of Roly Poly.

M.G. (Umbercollie, Goondiwindi)—

Your specimen is a species of roly poly, *Bassia tricuspis*, a native plant very closely allied to the galvanised burr. It is a very common weed in many parts of Queensland, particularly on the Darling Downs and in the Maranoa district. So far as is known the plant does not readily succumb to poisoning, or, at least, we doubt rather if poisoning would destroy the seeds it has all over it in tremendous quantities.

General Notes

In Memoriam.

JOHN NEWTON CREE.

The death of John N. Cree, formerly of the Maintenance Section of the Department of Agriculture and Stock, which occurred on August 10th is recorded with regret. The late Mr. Cree was born in 1864 at Bishop Auckland, Durham, England. He came to Queensland in 1884, and for many years was engaged in bridge building and other constructional work in different parts of the State. In 1912 he entered the service of the Department, in which he soon earned a high reputation for his industry, skill and faithful performance of duty—a reputation which he retained until his retirement in December, 1932. He is survived by his widow, a son and three daughters to whom sincere sympathy is extended.

Staff Changes and Appointments.

Mr. V. J. Brimblecombe, Gladstone, has been appointed an inspector under the Diseases in Stock Acts, the Slaughtering Act, and the Dairy Produce Acts, Department of Agriculture and Stock, and will be stationed at Monto.

Miss M. H. Makings, Turner avenue, New Farm, has been appointed an assistant cane tester at Qunaba Mill.

Mr. N. E. D. Arthur, Inspector of Stock, Tibooburra, New South Wales, has been appointed also an acting inspector of stock for Queensland.

Constable R. W. G. Lake, Malbon, has been appointed also an inspector under the Brands Acts.

Sergeants (2nd Class) J. Doolan (Landsborough) and A. E. Wootton (Nundah) have been appointed also inspectors under the Slaughtering Act.

Mr. M. W. J. Patullo, Dalrymple Heights, Eungella, via Mackay, has been appointed an honorary ranger under the Animals and Birds Acts.

Mr. J. E. Ladewig, Stock, Slaughtering, and Dairy Inspector, has been transferred from Monto to Biloela.

Mr. J. A. Gresty, an officer of the Forestry Department stationed in the Lamington National Park area, has been appointed also an honorary ranger under the Animals and Birds Acts and the Native Plants Protection Act.

Constable J. H. Hancock, Wowan, has been appointed also an inspector under the Brands Acts.

Mr. J. T. Littleton, Inspector of Stock, Innisfail, has been appointed also an inspector of brands. The Officer in Charge of Police at Oaks (Kidston) has been appointed also an acting inspector of stock.

Mr. James Cormack, Gin Gin Sugar Mill, Wallaville, has been appointed millowners' representative on the Gin Gin Local Sugar Cane Prices Board, vice W. C. Cunningham, resigned.

The following have been appointed honorary rangers under the Animals and Birds Acts:—Messrs. E. G. Gray, E. W. Carless, L. J. Dowzer, W. A. Elliott, R. F. Clark, H. Cox, E. J. Gould, C. G. Hawkins (Ayr), E. W. Ford, junr., W. Haller, W. G. Wall, F. J. Woods (Home Hill), J. Sexton (Brandon), L. Freeland, J. B. Blakeney, W. C. Bird, W. Ludwig, E. A. Robinson, M. B. Mayes, J. T. Dakers, H. Pemble, F. G. Hughes, and T. W. Hourigan (Giru).

Wild Life Preservation.

Orders in Council have been issued under the Animals and Birds Acts declaring the property of Messrs. Fitzpatrick at Lake Clarendon, via Gatton, and an area embracing Myall Creek, Dalby, to be sanctuaries for the protection of animals and birds.

Banana Industry Protection Board.

An Order in Council has been issued under the Banana Industry Protection Act providing for a levy on banana growers to be used for the maintenance of the Banana Industry Protection Board. The levy is at the rate of 1½d. per one and a-half bushel case, and 2d. in the £ sterling on bananas marketed in the bunch.

Pineapple Levy.

A regulation has been issued under the Fruit Marketing Organisation Acts extending for a further twelve months from the 21st August, 1937, the Pineapple Levy Regulation which was issued in April, 1936, and which empowers the Committee of Direction of Fruit Marketing to make a levy for the purposes of the abovementioned Acts on all pineapples marketed.

Peanut Board.

An Order in Council has been issued under the Primary Producers' Organisation and Marketing Acts extending the operations of the Peanut Board for the period from the 28th August, 1940, to the 27th August, 1947.

Peanut Board Election.

Result of the Peanut Board election (four members required:—

District No. 1 (Wienholt and Nanango), two members—Adermann, Charles Frederick, Kingaroy, 228 votes; Young, Leslie Vivian, Wooroolin, 204 votes; Christiansen, Norman James, Wooroolin, 101 votes; Crawford, Joseph Henry, Mannuen road, Kingaroy, 97 votes.

District No. 2 (Central Queensland), one member—Nothling, Rudolf Richard, Hut Creek, re-elected unopposed.

District No. 3 (Rest of Queensland), one member—Quilter, John Francis, Tolga, 40 votes; Gargan, John, Atherton, 31 votes; Humphrey, Sydney Harold, Tolga, 9 votes.

The sitting members for District No. 1 have been re-elected, and in District No. 3 Mr. Quilter will replace the present member, Mr. W. Whiting, who did not seek re-election this year.

The new Board will be appointed for a period of three years.

Council of Agriculture.

A regulation has been issued under the Primary Producers' Organisation and Marketing Acts prescribing the members of commodity boards who shall represent such boards on the Council of Agriculture. These include Messrs. J. McRobert (Maryborough) and W. J. Sloan (Malanda) (Butter Board), D. G. O'Shea (Southbrook) (Cheese Board), H. R. Brake (Wowan) (Cotton Board), T. D. McGeehan (Kairi) (Atherton Maize Board), C. Brumm (Woongoolba) (Arrowroot Board), C. F. Aderman (Kingaroy) (Peanut Board), R. V. Woodrow (Woodford) (Honey Board), E. Fitzgerald (Albany) (Barley Board), M. H. Campbell (Albany Creek) (Egg Board), H. Zischke (Hatton Vale) (Broom Millet Board), G. D. O'Neill (Allora) (Canary Seed Board), D. Johnston (Malanda) (Northern Pig Board), K. R. Hack (Nerang) (Committee of Direction of Fruit Marketing), G. Johnson (Mirani, Mackay) (Queensland Cane Growers' Council), W. J. Brimblecombe (Pirrinuan) (Wheat Board), G. A. Duffy (Forestry Department) (Plywood and Veneer and Northern Plywood and Veneer Boards).

Executive approval has also been given to the appointment of representatives of districts embracing Local Producers' Associations who shall be members of the Council of Agriculture. These are:—Messrs. R. R. Nothling, Hut Creek, via Ambrose (Central Queensland), R. H. Jamieson, Monto (Burnett), W. L. Osborne, Wondai (South Burnett), P. Daley, Maleny (Wide Bay), C. Bateman, Nundah (East Moreton), J. A. Sweeney, Mount Alford (West Moreton), J. Cameron, Lavelle (Darling Downs), W. E. Ashford, Hannaford, via Dalby (Western Downs), and C. W. Roseblade, Yungaburra (Atherton Tableland).

Cotton Board.

An Order in Council has been issued under the Primary Producers' Organisation and Marketing Acts, amending the constitution of the Cotton Board in respect of the establishment of a revolving fund in connection with the working account reserve fund moneys deducted from net realisations due to cotton growers

Rural Topics

Overstocking of Pastures.

That a large proportion of the most productive pastures of the State, coastal as well as inland, are overstocked is an undeniable fact. Unfortunately, too, the recent drought in the coastal areas has emphasised the harmful results of overstocking. The farms which were very much overstocked before the drought had the heaviest losses through its incidence. Many farmers and pastoralists are fully conscious of the bad effects of overstocking on pastures, and a large proportion of them insist on a moderate and judicious stocking of their holdings. As a consequence they are frequently very successful in good seasons and are the last to be affected by adverse seasons.

In a large proportion of cases, overstocking is due to economic conditions. Landholders often feel compelled to stock their properties to the limit during favourable seasons. Any general attack on the problem of overstocking, therefore, must inevitably involve financial considerations. It, however, is advantageous, invariably, even from the economic standpoint, not to overtax the productive capacity of the pastures.

Pastures which are not heavily stocked usually make rapid growth in the late summer and autumn, when the rainfall is sufficient. This is the case notably in some of the best paspalum pastures on the coast. This excess growth of grass is not eaten by stock, and when dry serves to protect the younger growth of grass from frost during the winter. With the approach of spring the younger growth of grass makes rapid headway, and forms a luscious pasture for stock. The general fertility of the soil of a pasture maintained in this way deteriorates much less rapidly than that of a pasture which is overstocked. The excess grass as it lodges and rots is added to the soil, and augments its organic constituents. Although this surplus late summer grass has a comparatively low feeding value on account of its low protein content, it has a high manurial value. It is composed very largely of organic matter which after decomposition has a marked reducing effect on essential soil minerals such as iron. It is due to this reducing effect of these organic constituents that the iron in the upper layers of the soil becomes soluble and available to pasture plants, fruit trees, and other economic crops.

—*W. D. Francis.*

On Nappamerrie—A "Desert" Vignette.

The fine stone house is clear of sand; the garden is of bougainvillea, fan-palm and cedar; and before and below is a great lagoon eight miles long and half a mile wide. A reedy island rises from the centre of this lake, whose depth is as much as 60 feet. . . .

In these hot brilliant days—sun saturated—of the alleged winter travelling is a joy. The long wide plain—gently rolling country from horizon to horizon; roly poly, or as Americans call it, "tumbleweed," rotates before the gentle wind, sowing seed as it travels.

A mob of horses full of curiosity, tinged with fear, gallop towards the car, wheeling within 200 yards of us and galloping away again, but to return. There is energy in a diet of Mitchell grass, yellowing on its stalk to a self-made hay; a great kick in the herbage, although the rainfall is low enough almost to justify the professors who study only tabulated rainfall and speak of the country as "desert."

Galahs by the thousand wheeling all at once, so that the sunlight strikes a flash of pink from their thousands of breasts; kangaroos bursting out of a scrub belt, rushing to concealment in another—life, warmth, sunlight, hot days, and cool nights, that are the ideal conditions for the production of Australia's finest wools. This is the "desert" of the text-books.

—*Randolph Bedford in "On the Western Edge."*

Orchard Notes

OCTOBER.

THE COASTAL DISTRICTS.

OCTOBER is frequently a dry month over the greater part of Queensland, consequently the advice that has been given in the notes for August and September regarding the necessity of thorough cultivation to retain moisture may be again emphasised. Thorough cultivation of all orchards, vineyards, and plantations therefore is imperative if the weather is dry, as the surface soil must be kept in a state of soil mulch, and no weeds of any kind must be allowed to grow, as they act only as pumps to draw out the moisture from the soil that is required by the trees or fruit-yielding plants.

All newly planted trees should be watched carefully and if they show the slightest sign of scale insects or other pests they should receive attention at once.

Bananas.

In the warmer districts banana planting may be continued. All winter trash should be removed and the stools cleaned up. If not already done, before the winter, young plantations planted the previous season should be desuckered without delay. Those desuckered last autumn should be gone over again, and old plantations also should receive attention. Grow to each stool the number of stems which experience proves to be permissible, but only allow each stem to grow a single follower. Borers will be active again soon, and trapping should be intensified towards the end of the month and supplies of Paris green and flour (one part to six by weight) made up in readiness. Caterpillar and grasshopper plagues often occur from the end of the month onwards, and it is wise to lay in a supply of arsenic pentoxide for use in the preparation of bran baits. Watch the plantation carefully for bunchy top, and kerosene and destroy any affected plants without delay. The season of vigorous growth is now commencing, and it will pay well in more and better fruit and in stronger suckers for the next crop to apply a dressing of a complete fertilizer to each stool. Cultivate well to retain moisture, aerate the soil, and kill weeds before they seed. This will also prepare the soil for the planting next month of a green cover crop such as *Crotalaria goreensis*, thus shading the soil, preventing erosion on slopes, and enriching the soil with nitrogen and humus.

Clean out all banana refuse from the packing shed, and resolve not to allow it to accumulate in future. This will reduce the risk of the development of many fungous rots in the packed fruit.

Pineapples.

From now onwards pineapples may be planted in most districts. Plough thoroughly, remembering always that in the life of a plantation will be several years during which it will be neither possible nor desirable to do more than disturb the surface layer. Obtain advice from the Department of Agriculture and Stock as to whether the soil is sufficiently acid, and, if not, how much sulphur to apply. Care must be taken in the layout of the rows to save time and labour in cultivation and harvesting, and minimise erosion. Select planting material with discrimination from healthy and vigorous plants of a good bearing type. Beware of planting "collars of slips." Always strip off the base leaves and dry in the sun for a few days, and plant shallow. As soon as the roots form, apply 3 cwt. of 10-6-10 fertilizer to the acre. All established plantations are due for their spring fertilizer at the rate of not less than 5 cwt. per acre. Keep down weeds with the Dutch hoe; but do not disturb the soil deeply, always remembering that the pineapple is shallow-rooted and receives a sharp setback if the roots are interfered with by the use of horse-drawn implements. Clean out all pineapple refuse from the packing shed and surroundings, and thus eliminate much fungous trouble in the summer pack.

THE GRANITE BELT, SOUTHERN AND CENTRAL TABLELANDS.

MUCH of the matter contained under the heading of "The Coastal Districts" applies equally to the Granite Belt, and the Southern and Central Tablelands; for on the spring treatment that the orchard and vineyard receives the succeeding crop of fruit very largely depends. The surface of all orchards and vineyards must be kept loose, and no weed growth of any kind should be allowed. In the western districts, irrigation should be given whenever necessary, but growers must not rely on irrigation alone, but should combine it with the thorough cultivation of the land so as to form and keep a fine soil mulch that will prevent surface evaporation.

All newly planted trees should be looked after carefully and only permitted to grow the branches required to form the future tree. All others should be removed as soon as they make their appearance. If there is any sign of woolly aphis, peach aphis, or scale insects, or of any fungus disease on the young trees, these diseases should be dealt with at once by the use of such remedies as black leaf forty, Bordeaux mixture, or a weak oil emulsion. In older trees, similar pests should be systematically fought, as if kept in check at the beginning of the season the crop of fruit will not suffer to any appreciable extent. Where brown rot has been present in previous years, the trees should be sprayed with Bordeaux mixture and lime sulphur according to the schedule recommended by the Department. All pear, apple, and quince trees should be sprayed with arsenate of lead—first when the blossom is falling, and at intervals of about three weeks. Spraying for codlin moth is compulsory in the fruit district of Stanthorpe, and wherever pomaceous fruit is grown it must be attended to if this insect is to be kept in check.

In the warmer parts a careful check should be kept for any appearance of the fruit fly, and, should it be found, every effort should be made to trap the mature insect and to gather and destroy any affected fruit. If this is done, there is a good chance of saving the earlier ripening summer fruit, if not the bulk of the crop. Tomato and potato crops will require spraying with Bordeaux mixture, as also will grape vines. Keep a very strict watch on all grape vines, and, if they have not been treated already, do not delay a day in spraying if any sign of an oil spot, the first indication of downy mildew, appears on the top surface of the leaf. Spraying with Bordeaux mixture at once, and following the first spraying up with subsequent sprayings, if necessary, will save the crop, but if this is not done and the season is favourable for the development of the particular fungus causing this disease, growers can rest assured that their grape crop will not take long to harvest.

Where new vineyards have been planted, spraying also is very necessary, as if this is not done the young leaves and growth are apt to be affected so badly that the plant will die.

SHEEP LAND FOR GRAZING HOMESTEAD SELECTION.

Portions 1 and 4, parish of Whittingham, comprising part of Alice Downs resumption, will be open for Grazing Homestead Selection at the Land Office, Blackall, on Thursday, 7th October, 1937, at 11 o'clock a.m.

The portions are situated about 20 miles north-west of Blackall. The areas are 20,099 acres and 20,210 acres respectively.

Each selection will be for a term of twenty-eight years, and the annual rental for the first period of seven years is 3¾d. and 4d. per acre respectively. Each must be stocked to its reasonable carrying capacity with the applicant's own sheep within a period of three years.

Portion 1 comprises open downs with some gidyea and boree forest, and portion 4 is nicely shaded first-class downs. Portion 1 is naturally watered, but portion 4 requires further artificial water. Both portions are well grassed with Mitchell, Flinders, barley, umbrella, and other grasses, and are suitable for breeding, woolgrowing, and fattening.

Free lithographs and full particulars may be obtained from the Lands Department, Brisbane, the Land Agents at Blackall and Barcaldine, and the Government Tourist Bureaux, Sydney and Melbourne.

Farm Notes

OCTOBER.

FIELD.—With the advent of warmer weather and the consequent increase in the soil temperature, weeds will make great headway if not checked; therefore, our advice for last month holds good with even greater force for the coming month. Earth up any crops which may require it, and keep the soil loose among them. Sow maize, cowpeas, sorghums, millet, panicums, pumpkins, melons, cucumbers, marrows. Plant sweet potatoes, yams, peanuts, arrowroot and ginger. Coffee plants may be planted out. There are voluminous articles in previous journals giving full instructions how to manage coffee plants from preparing the ground to harvesting the crop.

WORMS IN SHEEP.

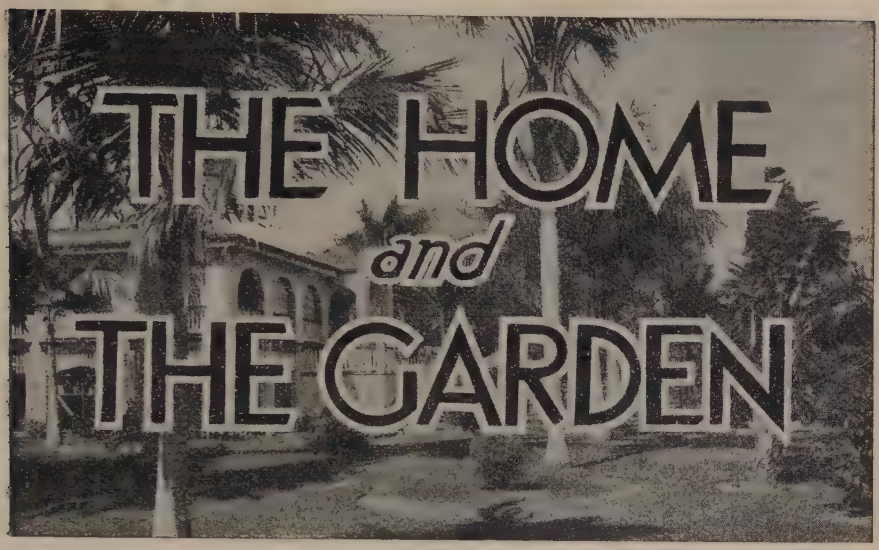
In recent times the problem of control of the parasitic worms in sheep has claimed attention in different parts of the world, more especially in South Africa, Great Britain, and Australia. Previously, drug treatment was successful only in the case of the stomach worm. Worms inhabiting the small intestine, e.g., the hair worms, and the large bowel, e.g., the nodule worm, were practically unaffected by drugs given in the ordinary way through the mouth. This was due to the fact that, under the conditions usually accompanying treatment, the drug passed into the first stomach or paunch and thus became diluted to such a degree that, by the time it passed through the three remaining stomachs of the sheep, it reached the small intestine in too weak a concentration to be in any way effective against the worms situated there or lower down in the gut.

The process of swallowing in sheep is governed by a groove which passes from the gullet along the roof of the first and second stomachs and eventually into the fourth stomach, which then leads directly into the small intestine. When the sheep grazes the food is passed directly into the paunch, to be later brought back into the mouth, chewed as a cud, and then swallowed again. This time, however, the groove closes and the thoroughly masticated food goes direct to the third stomach or bible and then is passed on with little delay into the fourth stomach. When the sheep drinks the groove is again closed and the water passes almost directly into the fourth stomach. It was therefore considered that if some way could be found of getting this groove to close during treatment the drug would pass directly into the fourth stomach and would reach the worms in the small intestine and large bowel in a sufficiently high concentration to kill most of them.

After a large number of experiments copper sulphate was found to produce this effect. Various strengths from 1 per cent. to 10 per cent. were tried, and it was found that a very small quantity of a 5-10 per cent. solution gave very consistent results. This work was carried out simultaneously in Australia and South Africa. For the small hair worms nicotine sulphate was then combined with the copper sulphate, with very excellent results. This drench was found to be effective against both stomach worms and tape worms. Another point which was brought out by this was that starvation before drenching was not desirable. It was previously considered that, by a starvation period prior to drenching, the locality in which the worms were present would be rendered free of ingested food and better contact of the drug with the worms would be given. It subsequently was found that this was more likely to be achieved without starvation, for with starvation the animals brought up the food from the first stomach, ruminated it, and then swallowed it, thus surrounding the worms in the third and fourth stomachs and in the small intestine with the ingested material. Details of this treatment may be obtained on application to the Animal Health Station.

In South Africa work along these lines has been continued against the nodule worm. It was found that by first placing in the mouth 2½ c.c. of a 10 per cent. copper sulphate solution the groove closed, and then by giving immediately afterwards a powder of copper tratrate, copper arsenate, and calcium hydroxide, a high efficiency against the nodule worm could be secured by two treatments on successive days. This treatment is now being tested in Australia, and is not yet available to the grazier.

—Dr. F. H. S. Roberts.



OUR BABIES.

Under this heading a series of short articles, by the Medical and Nursing Staffs of the Queensland Baby Clinics, dealing with the care and general welfare of babies has been planned in the hope of maintaining their health, increasing their happiness, and decreasing the number of avoidable deaths.

BABY'S BATH.

THE hour at which baby is bathed will vary with the requirements of different households. Some mothers may find it convenient to bath baby just before his second feeding time (say, between 9 and 10 o'clock in the morning). Whatever the hour chosen, it must be adhered to, so as not to upset the rhythm of baby's day. Of course, baby must never be bathed unless an hour (preferably more) has elapsed since his last feed.

Before starting to undress baby every precaution should be taken, in cold weather, to prevent loss of heat before, during, and after the bath. Undress, bath, and dress quickly, with no delay or dawdling and no unnecessary exposure of the skin. Choose a cosy corner or a warmed room, using a screen if necessary to protect baby from draughts. Prepare everything before lifting baby from his cot. Have dry, warm towels, washers, baby clothing, and all other requirements ready to hand.

When filling the bath always pour in the cold water first, lest the baby, if old enough, or his little brother or sister tumble in, and is badly or even fatally scalded. Then add sufficient hot water to make it comfortably warm, testing it carefully by putting your elbow, not your hand, into it just before putting the baby in.

It is not generally known that when the strong, healthy baby is a few months old he enjoys and derives benefit from being gradually accustomed to having tepid and, later, cool water squeezed over him before being removed from the bath. Let this be followed by a good

brisk rub down. Great care should be taken in cleansing and drying eyes, ears, lips, and folds of the skin. For this a gentle dabbing motion is best, and on no account should the mouth be wiped out. Nature provides natural juices in the mouth for perfect cleanliness. Any mild, superfatted soap may be used, but *use sparingly*. If used on the head great care must be taken to see that it is thoroughly rinsed off again, as any trace left is apt to cause dandruff and cradle-cap. Do not be afraid to dry the scalp thoroughly. Firm rubbing will not injure the baby through the soft spot.

Have two washers made from soft towelling or cellular cotton—one for his body, the other for his face. If preferred the face washer may be made from two or three folds of butter muslin. The washers must be boiled frequently. Do not use a sponge: it is hard to keep clean, and is liable to become foul and slimy and infested with microbes. Provide two towels also—a face towel and a body towel. The former should be made of soft absorbent material, such as butter muslin, and the latter of ordinary Turkish towelling, preferably linen. As a general rule powder is not needed. The baby should be dried so thoroughly that powder is quite unnecessary. If used carelessly, the powder tends to cake in the folds of the skin and to cause irritation and subsequent rawness. The folds of the skin should be dried with a towel, not with powder.

General Rules for Bathing.

1. Bath in a cosy corner of the room, using a screen if necessary to protect baby from draught.

2. Have everything in readiness before lifting baby from his cot.

3. Bath baby quickly. Remember, bathtime is not playtime.

4. Do not take baby out of a heated room before first wrapping him cosily in a shawl or blanket.

IN THE FARM KITCHEN.

SOME POTATO DISHES.

If, when boiling potatoes, you have them entirely covered with water, they will not turn black.

When baked potatoes are wanted, and there is little time to cook them, boil for fifteen minutes before baking. When roasted potatoes are wanted quickly, boil quickly for two minutes, drain well, steam till dry, then place with fat in a roasting tin under the roast. Turn them in the fat, so that they are greasy all over, before roasting.

Potato Chips.

Peel and wash the potatoes. Dry well. Cut in lengths of equal thickness moderately so to serve with grills or into strips like matches for cocktail chips, or trim the potato at each end, then cut into rounds the size of a crown-piece, or slice them very thinly to make crisps. No matter which way you cut them, make the frying fat hot, but it must on no account boil. Put a few potatoes in the frying basket. Plunge the basket into the fat. Cook the potatoes over a moderate heat till tender and slightly coloured. Remove the basket at once. Place the potatoes on a sieve to get partly cold. Replace the fat on the fire, and when it steams a blue vapour plunge the potatoes in a second time. Shake them about in the basket till they are swollen and crisp. Remove at once. When frying these do not put too many in the frying basket at once.

Lyonnaise Potatoes.

Take 1 pint cold boiled potatoes, ½ teaspoonful salt, 1½ tablespoonfuls chopped parsley, 1 teaspoonful chopped onion, 2 tablespoonfuls dripping, pepper to taste.

Slice the potatoes. Season with pepper and salt. Fry the onion in dripping until light brown. Add the potato and cook till all the fat is absorbed. Add the chopped parsley and serve with any cold meat.

Potato Dumplings.

Take 6 potatoes, 2 eggs, ½ cupful margarine, ¼ teaspoonful crushed herbs, 1½ teaspoonfuls salt, ½ cupful flour, ½ teaspoonful minced parsley.

Boil the potatoes, choosing medium-sized ones. Drain when ready. Steam to dry them, and mash when cold. Stir in the eggs, salt, flour, and seasoning. Mix and knead well till smooth. Shape into one long thick roll. Cut into half-inch pieces. Roll into dumplings the size of your finger. Cook in soup or boiling salted water for ten minutes. Drain in a colander. Place in a hot serving dish. Pour melted butter, cooked till brown, over the dumplings when served. If cooked in soup, serve the dumplings in the tureen with the soup.

Potato Croquettes.

Take 3 cupfuls hot mashed potato, 1 teaspoonful salt, 1 egg, pinch pepper, 2 tablespoonfuls butter or margarine, 1 teaspoonful minced parsley, 1 teaspoonful minced onion (this may be omitted), flour.

Put the potatoes, butter, salt, pepper, parsley, and onion into a basin, and mix well together with a wooden spoon. Cool. Shape into balls or potato shape. Roll in flour. Dip in lightly-beaten egg and coat with breadcrumbs. Fry in deep, smoking hot fat for three minutes. Drain and serve.

Stuffed Potatoes.

Take 6 baked potatoes, ¾ cupful grated cheese, 1 teaspoonful salt, ¼ cupful hot milk, 2 tablespoonfuls margarine (or butter).

Use large potatoes of good shape. When potatoes are soft, halve lengthwise. Scoop the inside into a saucepan. Mash. Mix with margarine, salt, milk, and pepper to taste. Return to the shells. Sprinkle with cheese. Place dabs of margarine on top. Bake in a baking tin in a moderate oven for five to ten minutes till crisp and brown on top.

Devilled Potatoes.

Take 18 new potatoes, 1½ tablespoonfuls butter, 1 egg-yolk, ¾ teaspoonful mixed mustard, 1½ teaspoonfuls vinegar, lard for frying, salt and pepper.

Boil potatoes, but not long enough to break. Drain, and melt lard to fry them in. When hot, drop in the potatoes. Fry five minutes, lift out, drain quickly, and turn into a saucepan containing the melted butter mixed with the mustard. Sprinkle vinegar over, season, and cook for three minutes, shaking constantly. Remove from the heat and strain off liquor. Stir in the beaten egg-yolk, add potatoes, heat well, and serve at once.

Baked Potato Mash.

Take 2 cupfuls cold mashed potatoes, 2 tablespoonfuls melted margarine, 1 egg, 1 cupful milk, pepper and salt.

Beat the margarine well into the potatoes. Stir in the well-beaten egg-yolk, milk, and lastly the stiffly frothed egg-white. Season to taste with salt and pepper. Bake in greased fireproof dish in a quick oven. Serve immediately.

Scalloped Potatoes.

Take 2 lb. potatoes, 3 to 4 oz. cheese, 1½ oz. butter, 2½ gills milk, salt and pepper, 1½ oz. flour.

Peel the potatoes, wash them and cut into thin slices. Put them into a buttered pie-dish in layers, sprinkling each layer with flour, pepper, salt, finely-grated cheese, and dabs of butter. Pour in the milk, sprinkle cheese on top, cover dish with a buttered paper, and bake the potatoes in a moderately hot oven for about one hour and a-half, until the potatoes are tender.

Duchesse Potatoes.

Take 1 lb. potatoes, 1 oz. butter, 1 egg, 2 tablespoonfuls milk, 1 oz. flour, salt and pepper.

Wash, peel, and boil the potatoes and drain them. Add the butter and milk and mash the potatoes with a fork. Beat the egg and mix nearly all of it with the potatoes. Season with salt and pepper. Turn potatoes on to a floured board and shake into five or six squares. Put in a flat baking tin and brush the tops with the remainder of the egg. Bake in a quick oven for ten to fifteen minutes.

Cream of Potatoes.

Take 2 lb. potatoes, 1 oz. butter, ½ pint milk, 1½ quarts water, 3 large onions, 1 teaspoonful minced parsley, salt and pepper.

Peel and slice the potatoes into a saucepan. Add the peel and sliced onions, water, and pepper and salt to taste. Cover and simmer two hours. Rub through a sieve and return to the saucepan. Add butter. Bring to the boil and whisk in boiling milk with an egg-beater. Add parsley and serve at once.

Hungarian Potatoes.

Take 3 cupfuls diced potatoes, 1 egg-yolk, 3 tablespoonfuls beef dripping, 2 tablespoonfuls flour, 1 teaspoonful minced onion, 1 cupful hot milk, 1 teaspoonful chopped parsley, 2 tablespoonfuls butter, salt, pepper, and paprika to taste.

Wash and peel potatoes before cutting them into cubes one-third of an inch square. Place in a saucepan. Cover with water, bring to the boil, and boil three minutes. Then drain well, melt dripping in frying pan, add potatoes, and cook on a low flame until potatoes are soft and lightly brown. Melt butter in a saucepan, add onion, cook for half a minute, then stir in flour and hot milk. Season to taste with salt, pepper, and paprika, then stir in egg-yolk. Pour sauce over potatoes and sprinkle with parsley.

Angus Potato Soup.

Take 1 lb. roast beef bones, 2 quarts water, 1 large carrot, 2 large tomatoes, 10 potatoes, 2 medium onions, seasoning.

Place the bones in a saucepan. Add water. Cover and simmer for one hour. Uncover and add the peeled and chopped onions, and potatoes, minced carrot, and scalded and peeled tomato. Simmer slowly for one and a half hours. Season to taste and serve very hot.

IN A WESTERN GARDEN.

Mr. Hughes's garden at Nockatunga shows a fruit production easy to all this western country. Soil is right. Sun heat is right. And when to these are added irrigation California and Mildura and Leeton have never bettered it. In 1910 I first saw New Mexico, and its soil was generally so poor that I doubt if there is much in Australia to compare with it. I passed through again in 1921, and in the eleven years intervening irrigation had made the desert a garden.

At Nockatunga, on water and white sand, grow grapes, oranges, persimmons, melons, cauliflower, and root crops to perfection. An all-steel waggon—for in this dry air waggons of wood fall to pieces—drawn by six camels and loaded with goat manure, carries the fertilizer to the crop. The Chinese gardeners will not use cow manure, and their selection of fertilizers is backed by results. Citrus fruits—almost equalling the oranges and grape fruit that were a feature of the 1937 show at Charleville—grow in plenty, the trees so heavily laden that some of the bearing branches trail upon the earth.

Nockatunga, a homestead of pisé, cool and wire-screened, is a sample of the station houses built when the old-time pastoralist had got over the hard work of the run, and could find time to make comfort for himself. Most of these more comfortable houses were built in the time of sheep. The work among cattle is more crude, and, generally, the cattleman's homestead reflects his work.

The sheepman is more settled. In growing the finer Australian wools he knows that the product will almost never know a glutted market. The homes of grazing selectors around the Quilpie district are modern houses, wire-screened, and some electrically lighted and refrigerated. They are an insurance of permanence in the settlement of this far-western region.

Nappamerrie, Nockatunga, and the beautiful palms, lawns, and gardens of Mount Margaret stay in the memory.—Randolph Bedford in "On the Western Edge."

RAINFALL IN THE AGRICULTURAL DISTRICTS.

TABLE SHOWING THE AVERAGE RAINFALL FOR THE MONTH OF JULY, IN THE AGRICULTURAL DISTRICTS, TOGETHER WITH TOTAL RAINFALL DURING 1937 AND 1936, FOR COMPARISON.

Divisions and stations.	Average Rainfall.		Total Rainfall	
	July.	No. of years' records.	July, 1937.	July, 1936.
North Coast.	In.		In.	In.
Atherton	1·03	36	3·44	2·07
Cairns	1·54	55	3·66	1·74
Cardwell	1·35	65	2·08	1·28
Cooktown	0·96	61	1·12	1·45
Herberton	0·85	51	1·66	1·16
Ingham	1·61	45	2·75	1·19
Innisfail	4·64	56	10·62	7·18
Mossman Mill	1·25	24	2·71	1·20
Townsville	0·61	66	0·62	0·27
Central Coast.				
Ayr	0·68	50	0·37	..
Bowen	0·93	66	0·47	..
Charters Towers	0·64	55	0·43	0·30
Mackay	1·68	66	0·90	0·55
Prosperine	1·55	34	1·25	1·36
St. Lawrence	1·39	66	0·51	0·23
South Coast.				
Biggenden	1·38	38	0·90	0·34
Bundaberg	1·84	54	1·60	0·75
Brisbane	2·23	85	1·15	1·31
Caboolture	2·18	50	0·73	1·28
Childers	1·69	42	2·08	0·54
Crohamhurst	2·98	44	1·42	1·80
Esk	1·98	50	0·65	1·56
Gayndah	1·46	66	1·45	0·46
Gympie	2·11	67	0·96	1·17
Kilkivan	1·60	58	0·69	0·45
Maryborough	1·91	66	2·54	1·48
Nambour	2·69	41	2·12	1·12
Nanango	1·66	55	0·95	1·24
Rockhampton	1·77	66	1·89	0·40
Woodford	2·37	50	0·61	1·57

Divisions and stations.	Average Rainfall.		Total Rainfall	
	July.	No. of years' records.	July, 1937.	July, 1936.
Central Highlands.	In.		In.	In.
Clermont	1·04	66	0·80	0·73
Gindie	1·13	38	..	0·71
Springsure	1·23	68	0·43	1·80
Darling Downs.				
Dalby	1·74	67	0·97	2·00
Emu Vale	1·61	41	0·88	2·59
Hermitage	1·75	31	0·74	1·48
Jimbour	1·54	49	0·86	2·05
Miles	1·66	52	0·86	2·50
Stanthorpe	2·05	64	0·90	2·87
Toowoomba	2·11	65	1·08	2·40
Warwick	1·86	72	0·82	2·50
Maranoa.				
Roma	1·48	63	0·60	1·69
State Farms, &c.				
Bungeworgorai	1·43	22	..	1·20
Gatton College	1·42	38	0·98	1·47
Kairi	1·11	21	..	..
Mackay Sugar Experiment Station	1·50	40	0·50	0·45

A. S. RICHARDS, Divisional Meteorologist.

CLIMATOLOGICAL TABLE—JULY, 1937.

COMPILED FROM TELEGRAPHIC REPORTS.

Districts and Stations.	Mean Atmospheric Pressure, at 9 a.m.	Shade Temperature. Means.		Shade Temperature. Extremes.				Rainfall.	
		Max.	Min.	Max.	Date.	Min.	Date.	Total.	Wet Days.
Coastal.	In.	Deg.	Deg.	Deg.		Deg.		Points.	
Cooktown	29·99	74	65	81	21	61	10, 12	112	7
Herberton	..	66	53	77	1	42	6, 7	166	13
Rockhampton	30·20	72	53	80	23	40	6	189	7
Brisbane	30·27	68	50	77	23	42	2, 3	115	13
Darling Downs.									
Dalby	30·28	67	38	74	18	28	4	97	3
Stanthorpe	..	55	32	66	20	18	4	90	6
Toowoomba	..	63	42	71	18	32	6, 26	108	4
Mid-Interior.									
Georgetown	30·05	80	56	86	23, 31	41	25	Nil	..
Longreach	30·20	73	45	80	19, 21	34	5, 6	38	3
Mitchell	30·29	65	35	74	21	25	4, 5	88	3
Western									
Burketown	30·06	81	56	88	22	45	6	Nil	..
Boulia	30·21	73	46	83	31	37	6	Nil	..
Thargomindah	30·27	66	40	78	31	32	5, 25	Nil	..

ASTRONOMICAL DATA FOR QUEENSLAND.

TIMES COMPUTED BY A. C. EGLINTON.

TIMES OF SUNRISE, SUNSET, AND MOONRISE.

AT WARWICK.

	September. 1937.		October. 1937.		Sept. 1937.	Oct. 1937.
	Rises.	Sets.	Rises.	Sets.	Rises.	Rises.
					a.m.	a.m.
1	6·7	5·37	5·33	5·51	2·56	3·4
2	6·6	5·37	5·32	5·51	3·45	3·43
3	6·5	5·38	5·31	5·52	4·27	4·18
4	6·4	5·38	5·29	5·53	5·6	4·53
5	6·3	5·39	5·28	5·53	5·43	5·28
6	6·2	5·39	5·27	5·54	6·19	6·5
7	6·1	5·40	5·26	5·54	6·54	6·43
8	5·58	5·40	5·25	5·55	7·29	7·24
9	5·57	5·41	5·24	5·55	8·6	8·6
10	5·56	5·41	5·23	5·56	8·46	8·52
11	5·55	5·42	5·22	5·56	9·26	9·42
12	5·53	5·42	5·21	5·57	10·10	10·34
13	5·52	5·43	5·20	5·57	10·59	11·29
						p.m.
14	5·51	5·43	5·19	5·58	11·51	12·25
					p.m.	
15	5·50	5·44	5·18	5·58	12 46	1·20
16	5·49	5·44	5·17	5·59	1·40	2·17
17	5·48	5·45	5·16	6·59	2·37	3·17
18	5·47	5·45	5·15	6·0	3·36	4·18
19	5·45	5·45	5·14	6·1	4·35	5·21
20	5·44	5·46	5·12	6·1	5·34	6·29
21	5·43	5 46	5·11	6·2	6·36	7·37
22	5·42	5·47	5·10	6·3	7·36	8·33
23	5·41	5·47	5·9	6·3	8·48	9·46
24	5·40	5·47	5·8	6·4	9.54	10·46
25	5·39	5·48	5·8	6·5	10·56	11·37
26	5·38	5·48	5·7	6·5	11·58	a.m.
27	5·37	5·49	5·6	6·6	..	12·23
					a.m.	
28	5·36	5·49	5·6	6·7	12·52	1·6
29	5·35	5·50	5·5	6·7	1·40	1·44
30	5·34	5·50	5·4	6·8	2·24	2·19
31			5·3	6·9		2·53

Phases of the Moon, Occultations, &c.

5th Sept.	●	New Moon	8 54 a.m.
13th ,,	☽	First Quarter	6 57 a.m.
20th ,,	○	Full Moon	9 32 p.m.
27th ,,	☾	Last Quarter	3 43 p.m.

Apogee, 12th September, at 8 a.m.
Perigee, 24th September, at 7 a.m.

An interesting phenomenon will occur in the early morning of the 24th, when Venus, in Leo, rising at 3.55 a.m., will be separated by only about a fourth of a degree from Regulus, the first magnitude star on the ecliptic. An interested observer may see them until all but the brightest stars are lost in the approaching daylight.

On the 25th Saturn will be in opposition to the Sun, rising as the Sun sets. It will then be very near the position in Pisces where the Sun crosses the celestial equator on the 21st March. Northward and a little to the east of Saturn are the two stars which mark the eastern side of the Great Square of Pegasus.

On the 30th Mercury will arrive at its greatest distance, 18 degrees west of the Sun. Rising at 4.24 a.m., the swiftest planet will be near the invisible and most tardy of all planets, Neptune, on the outskirts of the solar system, taking 164 years to complete a circuit around the Sun, whereas Mercury, nearest the Sun, runs through all the twelve Zodiacal constellations in 87 days.

Mercury rises at 6.54 a.m., 47 minutes after the Sun, and sets at 7.16 p.m., 1 hour 39 minutes after it, on the 1st; on the 15th it rises at 5.35 a.m., 15 minutes before the Sun, and sets at 5.39 p.m., 5 minutes before it.

Venus rises at 4.5 a.m., 2 hours 2 minutes before the Sun, and sets at 2.47 p.m., 2 hours 50 minutes before it, on the 1st; on the 15th it rises at 4.8 a.m., 1 hour 42 minutes before the Sun, and sets at 3.8 p.m., 2 hours 36 minutes before it.

Mars rises at 10.53 a.m. on the 1st and sets at 12.51 a.m. on the 2nd; on the 15th it rises at 10.31 a.m. and sets at 12.35 a.m. on the 16th.

Jupiter rises at 1.36 p.m. on the 1st, and sets at 3.34 a.m. on the 2nd; on the 15th it rises at 12.38 p.m. and sets at 2.28 a.m. on the 16th.

Saturn rises at 7.26 p.m. on the 1st and sets at 7.34 a.m. on the 2nd; on the 15th it rises at 6.23 p.m. and sets at 6.37 a.m. on the 16th.

The Southern Cross will be at its lowest position about 2 a.m., and therefore disappear at Warwick about midnight at the beginning of the month and 2 hours earlier at the end.

4th Oct.	●	New Moon	9 58 p.m.
13th ,,	☽	First Quarter	1 47 a.m.
20th ,,	○	Full Moon	7 48 a.m.
26th ,,	☾	Last Quarter	11 26 a.m.

Apogee, 10th October, at 4 a.m.
Perigee, 22nd October, at 2 a.m.

For places west of Warwick and nearly in the same latitude, 28 degrees 12 minutes S. add 4 minutes for each degree of longitude. For example, at Inglewood, add 4 minutes to the times given above for Warwick; at Goondiwindi, add 8 minutes; at St. George, 14 minutes; at Cunnamulla, 25 minutes; at Thargomindah, 33 minutes; and at Oontoo, 48 minutes.

The moonlight nights for each month can best be ascertained by noticing the dates when the moon will be in the first quarter and when full. In the latter case the moon will rise somewhat about the time the sun sets, and the moonlight then extends all through the night; when at the first quarter the moon rises somewhat about six hours before the sun sets, and it is moonlight only till about midnight. After full moon it will be later each evening before it rises, and when in the last quarter it will not generally rise till after midnight.

It must be remembered that the times referred to are only roughly approximate; as the relative positions of the sun and moon vary considerably.

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